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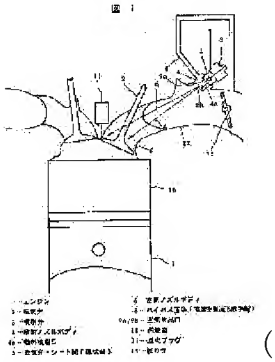
(54) FUEL SUPPLY DEVICE OF ENGINE



(57)Abstract:

PROBLEM TO BE SOLVED: To prevent fuel adhesion to a combustion chamber, to improve particulating of fuel, to improve forming of air-fuel mixture in the combustion chamber, and to increase combustion efficiency and exhaust emission control.
SOLUTION: An injection valve 3 is disposed in the downstream of a throttle valve 15 of an intake passage. Air in the upstream of the throttle valve is jetted from peripheries 9a and 9b of the injection port of the injection valve 3 using pressure difference from a passage 8 bypassing the upstream of the throttle valve 15. The high speed air flow jetted from the bypass passage 8 surrounds injected fuel and prevents diffusion of the fuel, and guides the fuel to a position near the center of the combustion chamber of the upper surface of the head of an intake valve 2 or a position near the center of the combustion chamber between the intake valve and a sheet 5. A high speed air flow forming means may be interchangeable with a pipe for guiding the fuel and air flow.

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The fuel supply system of the engine characterized by having set up so that it may have a means to form high-speed airstream in an engine inhalation-of-air path at least in the fuel supply system equipped with the fuel injection valve at the time of low load driving and this high-speed airstream and the injection fuel of said fuel injection valve may arrive at the location of combustion chamber central approach , or the location of the combustion chamber central approach between an inlet valve and a sheet intensively , while on the top face of head of an engine inlet valve .
[Claim 2] In claim 1, said fuel injection valve is arranged on the throttle valve lower stream of a river of said inhalation-of-air path. Said high-speed airstream means forming Make the throttle valve of said inhalation-of-air path bypass, and the air of the throttle valve upstream at the bypass path which blows off from the perimeter of the injection tip of said fuel injection valve High-speed airstream which blows off from the bypass path (high-speed airstream) the differential pressure of a throttle valve vertical style -- being generated, surrounding the injection fuel of said fuel injection valve, and preventing diffusion of a fuel, so that this fuel may be led to the location of combustion chamber central approach, or the location of the combustion chamber central approach between an inlet valve and a sheet, while on the top face of head of said inlet valve The fuel supply system of the engine characterized by having set up.
[Claim 3] It has two or more fuel injection tips to which said engines are 2 inlet valves / cylinder mold, and said fuel injection valve was equivalent to two inlet valves in claim 1. The branching path corresponding to each inlet valve is formed in the location near the cylinder of said inhalation-of-air path. To one side of this branching path The swirl control valve (it abbreviates to SCV hereafter) by which closing motion control is carried out according to an engine load is prepared. And said high-speed airstream means forming Make the throttle valve of said inhalation-of-air path bypass, and the air of the throttle valve upstream at the bypass path which blows off from the perimeter of each injection tip of said fuel injection valve Making it deviate to the

direction which this high-speed airstream blowing off unifies the fuel injected from each fuel injection tip of said fuel injection valve, and does not have SCV among said branching paths The fuel supply system of the engine characterized by setting up and changing so that this fuel may be led to the location of combustion chamber central approach, or the location of the combustion chamber central approach between an inlet valve and a sheet with high-speed airstream, while on the top face of head of one of the two's inlet valve.

[Claim 4] It is the fuel supply system of the engine which two or more arrangement of the air port of said bypass path is carried out around the fuel injection tip of said fuel injection valve in claim 2 or claim 3, and is characterized by these air ports differing in a path.

[Claim 5] The fuel supply system of the engine characterized by having the lengthwise direction air-current means forming which makes the air current between engine inlet valve and sheet the flow of a lengthwise direction at least at the time of low load driving in the fuel supply system which equipped the engine inhalation-of-air path with the fuel injection valve.

[Claim 6] In claim 5, the path of the throttle valve lower stream of a river of said inhalation-of-air path branches to two. When the auxiliary valve by which closing motion control is carried out according to an engine load is prepared in one branching path among this branching path and this auxiliary valve is closed The branching path of the direction which does not have an auxiliary valve functions as said lengthwise direction air-current means forming. The fuel supply system of the engine characterized by having set up so that the air which passes through a branching path without this auxiliary valve may bypass said fuel injection valve and may form a lengthwise direction air current in the location of combustion chamber central approach locally among between engine inlet valve and sheet.

[Claim 7] It is the fuel supply system of the engine characterized by having two or more fuel injection tips to which said engines are 2 inlet valves / cylinder mold in claim 5, and said fuel injection valve was equivalent to two inlet valves, forming the branching path corresponding to each inlet valve in the location near the cylinder among said inhalation-of-air paths, and having established said lengthwise direction air-current means forming for said every branching path.

[Claim 8] While said engines are 2 inlet valves / cylinder mold, the branching path corresponding to each inlet valve is formed in the location near the cylinder among said inhalation-of-air paths in claim 5 and a fuel is injected by only one side of this branching path from said

fuel injection valve It is divided into two near the cylinder of the branching path by the side of [by which fuel injection is carried out] this up and down. The fuel supply system of the engine characterized by having set up so that the auxiliary valve by which closing motion control is carried out according to engine loaded condition may be prepared in a bottom path among beam paths at this rate and it may function considering a top path as said lengthwise direction air-current means forming.

[Claim 9] The fuel supply system of the engine with which an upper path is characterized by making it have functioned as said lengthwise direction air-current means forming when a path is divided up and down, the auxiliary valve by which closing motion control is carried out according to an engine load is prepared in that bottom path and this auxiliary valve closes a part of throttle valve lower stream of a river of said inhalation-of-air path in claim 5.

[Claim 10] It is the fuel supply system of the engine which prepares the supplementary air path which said fuel injection valve is arranged on the throttle valve lower stream of a river of said inhalation-of-air path, and introduces the supplementary air from the throttle valve upstream of said inhalation-of-air path in the fuel supply system which equipped the engine inhalation-of-air path with the fuel injection valve, and blows off near the engine inlet valve, and is characterized by to have set up said supplementary air path so that the air of a lengthwise direction air current may be blown off towards the location of combustion chamber central approach among between said inlet valve and its sheet.

[Claim 11] The fuel supply system of the engine characterized by arranging the idle control valve for controlling the cut valve or the idle rpm closed at the time of idle operation in said supplementary air path in claim 10.

[Claim 12] In the fuel supply system which equipped the engine inhalation-of-air path with the fuel injection valve, each engine cylinder has two inlet valves. The throttle valve lower stream of a river of said inhalation-of-air path branches to two corresponding to said inlet valve. When the auxiliary valve by which closing motion control is carried out according to engine load operational status is prepared in one side of this branching path and said auxiliary valve is open The fuel supply system of the engine characterized by having set up so that the injection fuel of said fuel injection valve may deviate to the direction without an auxiliary valve among said branching paths when the fuel from said fuel injection valve is injected towards the both

sides of said branching path and said auxiliary valve closes.
[Claim 13] The fuel supply system of the engine characterized by for each engine cylinder to have two inlet valves, and for the throttle valve lower stream of a river of said inhalation-of-air path to branch to two corresponding to said inlet valve in the fuel supply system which equipped the engine inhalation-of-air path with the fuel injection valve, and to make the air port of the bypass path which takes in the supplementary air from the throttle valve upstream of said inhalation-of-air path counter the end side of the septum of said branching path in the upper location near [said] the branching path, and to change.
[Claim 14] The fuel supply system of the engine characterized by connecting the pipe which leads the fuel injected to the location of combustion chamber central approach, or the location of the combustion chamber central approach between an inlet valve and a sheet while on the top face of head of an engine inlet valve to the injection tip of said fuel injection valve, and changing in the fuel supply system which equipped the engine inhalation-of-air path with the fuel injection valve.
[Claim 15] In the fuel supply system which equipped the engine inhalation-of-air path with the fuel injection valve, said fuel injection valve is arranged on the throttle valve lower stream of a river of said inhalation-of-air path. It has the bypass path which bypasses said throttle valve and blows off the air of the throttle valve upstream from the perimeter of an injection tip of said fuel injection valve. The pipe towards an engine inlet valve is connected to the injection tip of a fuel injection valve. And the include angle of this pipe The fuel supply system of the engine characterized by setting up and changing so that the injected fuel may be led to the location of combustion chamber central approach, or the location of the combustion chamber central approach between an inlet valve and a sheet with the air which blows off from said bypass path, while on the top face of head of an engine inlet valve.
[Claim 16] It is the fuel supply system of the engine characterized by for said pipe letting an injection fuel to the inside path, and having let the air from said bypass path pass to through and an outside path as duplex path structure in claim 15.
[Claim 17] It is the fuel supply system of the engine which said engine equips each cylinder with two inlet valves, and it branches near the cylinder to two, and SCV by which closing motion control is carried out according to engine loaded condition is prepared in one side of this branching path, and is characterized by introducing said pipe into the direction which does not have SCV among said branching paths among said

inhalation-of-air paths in claim 15 or claim 16 corresponding to this.
[Claim 18] In the fuel supply system which equipped the engine inhalation-of-air path with the fuel injection valve, each engine cylinder has two inlet valves. The throttle valve lower stream of a river of said inhalation-of-air path branches to two corresponding to said inlet valve. And it has the bypass path where said fuel injection valve is arranged [path] on the throttle valve lower stream of a river of said inhalation-of-air path, said throttle valve is bypassed, and the air of the throttle valve upstream blows off from the perimeter of an injection tip of said fuel injection valve. The fuel supply system of the engine characterized by connecting the pipe towards an engine inlet valve to the injection tip of a fuel injection valve, making the outlet of this pipe counter the upstream of the septum which branches said inhalation-of-air path with the end face of this septum in a near location, and changing.

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the fuel supply system of the engine which equipped the inhalation-of-air path with the fuel injection valve.
[0002]
[Description of the Prior Art] the suction-port fuel injection equipment (fuel supply system) put in practical use more widely than before -- the gaseous mixture of 177 pages - 181 pages "gasoline engine of symposium [/ 8th internal combustion engine] lecture collected works ('90-1- 24, 25, Tokyo) -- it was what the injection fuel of a fuel injection valve

collides and adheres to the partial part of the cylinder wall which counters, evaporates gradually, and is conveyed by the swirl in a cylinder as indicated by research" about formation.
[0003] Moreover, so that it may be indicated by JP,61-80365,U, JP,1-76560,U, JP,2-141678,U, JP,2-141679,U, etc. So that it may be indicated by what the air from the throttle valve upstream was made to blow off around the nozzle of a fuel injection valve using the supplementary air path which bypassed the throttle valve, and attained fuel atomization to it, and JP,61-16261,A and JP,61-226563,A While making the injection fuel of a fuel injection valve collide with the inhalation-of-air path wall near a suction port Preparing the swirl path which makes the air from the throttle valve upstream blow off in a suction-port wall **** What prepared the pipe to which the air of the throttle valve upstream is led near the engine inlet valve is known so that it may be indicated by JP,59-231133,A.
[0004]
[The technical problem which invention will solve and to carry out] Although it is carried to the airstream at which most fuels collide with an inhalation-of-air path wall surface or an inlet valve, or an inlet valve turns by the way although various fuel supply systems are proposed from before as mentioned above, and collided with the combustion chamber wall surface of a cylinder, while it has been liquefied, according to such a method, it is easy to go into a combustion chamber, without the ability evaporating the part adhering to an inhalation-of-air path wall surface, an inlet valve, and a cylinder wall. Consequently, since the incomplete combustion of the fuel which is not evaporated is carried out and it is exhausted, it becomes an ununiformity, and the gaseous mixture which becomes the cause by which the amount of unburnt hydrocarbon increases, and is introduced into a combustion chamber forms a deep gas reservoir in the lower part, and becomes the cause of reducing combustion efficiency.
[0005] Therefore, conventionally, although the fuel which the inhalation-of-air line carried out fuel-injection timing of an injection valve before, and adhered to inhalation-of-air ******, an inlet valve, etc. is made to evaporate with heat, just this is not enough as evaporation of a liquefied fuel, and especially enough at the time of low-temperature starting. [just]
[0006] Although the approach of complicating the configuration of a piston conventionally, and giving turbulence to gaseous mixture and making gaseous mixture homogeneity according to the SUKYUSSHU effectiveness is indicated by the above-mentioned paper in order to cope

with such a problem, the configuration of a piston becomes complicated and the increase of surface area and heat loss tend to increase.
[0007] It is necessary to make the fuel of an injection valve detailed as other cures below at 10-micron meter. However, atomization of the fuel by the air current, the atomization by the supersonic wave, etc. can only process a little thing fuel, and since it has left the problem liquid-membrane-ized by adhering to a wall surface, an inlet valve, etc., they have not resulted until they raise sufficient effectiveness.
[0008] This invention is made in view of the above point, and the purpose solves the above-mentioned problem, makes confusion mind formation of a combustion chamber good, and is to offer combustion efficiency and the fuel supply system which can raise exhaust air purification.
[0009]
[Means for Solving the Problem] This invention proposes the following technical-problem solution means fundamentally, in order to attain the above-mentioned purpose.
[0010] (1) One has a means to form high-speed airstream in an engine inhalation-of-air path at least in the fuel supply system equipped with the fuel injection valve at the time of low load driving, and it proposes what was set up so that this high-speed airstream and the injection fuel of said fuel injection valve might arrive at the location of combustion chamber central approach, or the location of the combustion chamber central approach between an inlet valve and a sheet intensively, while on the top face of head of an engine inlet valve.
[0011] (2) Another proposes the thing equipped with the lengthwise direction air-current means forming which makes the air current between engine inlet valve and sheet the flow of a lengthwise direction at least at the time of low load driving in the fuel supply system which equipped the engine inhalation-of-air path with the fuel injection valve.
[0012] (3) Another connects a pipe to the injection tip of a fuel injection valve, and proposes what leads an injection fuel to the location of combustion chamber central approach, or the location of the combustion chamber central approach between an inlet valve and a sheet while on the top face of head of an engine inlet valve with this pipe.
[0013] In addition, although various means for improving the characteristics of mixing about 2 inlet valves / cylinder mold engine are also proposed, an example explains this.
[0014]
[Function] According to the technical-problem solution means of (1), even if it is at the partial-load-operation time, such as low loading,

high-speed airstream can be locally generated using high-speed airstream means forming. And for example, if an injection fuel is made to collide with an inlet valve at the front like an inhalation-of-air line, local liquid membrane will be formed in the combustion chamber central approach on the top face of head used as the collision location.
[0015] The adhesion fuel of a head is evaporated with heat by this condition, and fuel evaporation is promoted by the Venturi effect in case high-speed airstream passes an inlet valve, while the adhesion fuel which is not evaporated is blown away by the airstream of the high speed which aimed at the above-mentioned injection fuel collision, homotopic, or the location of the combustion chamber central approach between the inlet valve and sheet of that near and atomizing it.
[0016] And they are agitated from a center by the vortex generated in a glow room, are diffused around it, and form good gaseous mixture in the whole combustion chamber while they prevent the reattachment of the fuel to a cylinder wall (combustion chamber wall), since this evaporation fuel (a atomization fuel is included) and high-speed airstream go into the central approach of a combustion chamber.
[0017] moreover -- even if a fuel will be atomized according to the Venturi effect of the high-speed flow which passes an inlet valve and a fuel will moreover adhere in part between an inlet valve and a sheet, when an inlet valve opens if it lets a fuel and high-speed airstream pass in the location of combustion chamber central approach among between an inlet valve and a sheet even if it is the case where an inhalation-of-air line is made to inject a fuel by the way -- this -- high-speed airstream -- blowing away -- it atomizes. and a atomization fuel should enter in the center of a combustion chamber straight, and since it is agitated by the vortex produced by high-speed airstream at this time, the same operation as the above should do it -- good gaseous mixture -- formation is realized.
[0018] partial load operating range, such as low load driving with which the above-mentioned operation has the air rate of flow in an inhalation-of-air path in a low-speed condition, -- setting -- compulsory -- high-speed airstream -- forming -- good gaseous mixture -- since formation is promoted, it is especially effective. even if it does not borrow the force of the means which in high-speed load operation makes such high-speed air since the air current in an inhalation-of-air path is in a high-speed condition -- good gaseous mixture -- it can form.
[0019] In addition, formation of the high-speed airstream at the time of low load driving leads the air of the throttle valve upstream to a throttle valve lower stream of a river in the style of [of a throttle

valve] the upper and lower sides at a bypass path etc. using differential pressure, and is attained with devising the outlet of the bypass path, the direction of the air blowdown, etc.
[0020] According to the technical-problem solution means of (2), the air current between an inlet valve and a sheet becomes a lengthwise direction, a combustion chamber is made to generate a small lengthwise direction vortex unlike the flow (lateral flow) along the slope of the conventional inlet valve, and a atomization fuel rides on this minute eddy, and is spread from the center of a combustion chamber. Consequently, wall surface adhesion can be prevented and uniform gaseous mixture is formed in a combustion chamber.
[0021] leading a atomization fuel in the center of a combustion chamber like an operation of (1), since according to the technical-problem solution means of (3) the fuel injected is led in the location of combustion chamber central approach among between combustion chamber central approach, or an inlet valve and a sheet, without spreading a fuel with a pipe while on the engine top face of an inlet valve -- adhesion of the fuel to a cylinder wall -- it can prevent -- good gaseous mixture -- formation can be aimed at.
[0022]
[Example] A drawing explains the example of this invention.
[0023] The 1st example of this invention is shown in drawing 1 - drawing 4 . This example is an example of claims 1 and 2.
[0024] An engine 1 is the usual gasoline engine. The fuel injection valve 3 is arranged two about an inlet valve in the throttle valve 15 down-stream location of the inhalation-of-air path 22. As for a fuel injection valve (it considers as an injection valve hereafter) 3, an electromagnetic injector is used. The fuel injection tips 4a and 4b of the nozzle body 4 of an injection valve 2 have turned to the central site of a combustion chamber 10, while on the top face of head of an inlet valve 2.
[0025] The air nozzle body 6 is formed in the surroundings of a nozzle body 4, and the nozzle holes 9a and 9b of the air nozzle body 6 are arranged in the tip periphery of the fuel injection tips 4a and 4b.
[0026] Nozzle holes 9a and 9b turn into an air port of the path 8 which made the throttle valve 15 of the inhalation-of-air path 22 bypass, and the inlet port of the bypass path 8 opens a course of them for the throttle valve 15 upstream.
[0027] The number of nozzle holes 9a and 9b is two, and the configuration, the include angle, and the location are set up so that it may arrive at the place (combustion chamber central approach near

[here] an ignition plug 11) where the fuel injected from an injection valve 3 was surrounded by the high-speed airstream which blows off from the air nozzle holes 9a and 9b in, and it separated from cylinder 10 wall while on the top face of head of an inlet valve 2 intensively. High-speed airstream is produced when the differential pressure of a throttle valve vertical style like low load driving becomes large.
[0028] The jet from the air nozzle holes 9a and 9b is colliding aslant, and an ellipse-like jet's (airstream's) being compounded for the cross section, and changing the aperture of two nozzle holes 9a and 9b, a jet is deflected in the direction of broken-line B, and the injection fuel passing through the inside of this is also deflected in the direction of broken-line B. Nozzle holes 9a and 9b are designed so that this direction of deviation B may become among the annular sections (between an inlet valve 2 and its sheet) 5 the direction near the location 11 of combustion chamber 10 central approach, i.e., an ignition plug.
[0029] A fuel is made to blow off from an injection valve 3 in this example at the front like the inhalation-of-air line of an engine 1.
[0030] At the time of partial load operation, the fuel injected from the nozzle 4 goes into orbit of the direction of B, without being surrounded from nozzle holes 9a and 9b to an air blast, and being spread, and collides with the location near [as shown in drawing 2] the ignition plug 11 in the head top face of an inlet valve 2 locally. When an inlet valve 2 opens, as shown in drawing 3 , it is the high-speed airstream (at this time) from nozzle holes 9a and 9b. a fuel is injected from a nozzle 4 -- **** -- it passing through the location of combustion chamber central approach among the annular sections 5, and, while the fuel which adhered to the inlet valve 2 by this is blown away and atomized Evaporation promotion is carried out by the so-called Venturi effect attracted with negative pressure, it enters in the combustion chamber 10 center, and good gaseous mixture is formed in about 11 ignition plug.
[0031] According to this example, it can avoid that a fuel adheres to an inhalation-of-air tube wall, a cylinder wall, and a piston side, without spreading a fuel.
[0032] Moreover, as shown in E1 and E2 of drawing 3 , the air E which passes along an inlet valve 2 flows so that a fuel may be wrapped, a fuel rides the flow of E1, and is led in the center of a combustion chamber, and the reattachment to a cylinder wall is prevented.
[0033] Furthermore, since minute turbulence can be built in a combustion chamber 10 with the air of an air nozzle 6 as another effectiveness of this example and the atomization fuel is spread from the center of a

combustion chamber in this small vortex, homogeneity formation of gaseous mixture is promoted.
[0034] Next, if an engine load increases, the pressure of an inlet pipe 22 will increase, the rate of the jet B of nozzle holes 9a and 9b falls, and as A of drawing 4 shows, a fuel comes to be supplied to the annular section 5 at homogeneity. At this time, since the rate of E1 and E2 of the air which passes along an inlet valve 2 becomes large even if an air nozzle 6 does not form high-speed airstream, a fuel is re-atomized like D with inhalation air.
[0035] Next, drawing 5 and drawing 6 explain the 2nd example. The 2nd example is an example of claim 1, claim 2, and claim 3.
[0036] This example is the fuel supply system of the method which each cylinder 10 of an engine 1 has two inlet valves 2 and 21, and has two or more injection tips 4a and 4b to which the nozzle body 4 of a fuel injection valve 3 corresponded to two inlet valves.
[0037] Septum 22' is prepared in an about ten-cylinder location among the inhalation-of-air paths 22, the branching paths 22a and 22b corresponding to each inlet valves 2 and 21 are formed, and the swirl control valve (it abbreviates to SCV hereafter) 13 of this branching path by which closing motion control is carried out, corresponding to an engine load in 22a on the other hand is formed. This SCV13 serves as close at the time of open and low loading at the time of a heavy load.
[0038] On the other hand, a fuel injection valve 3 is located in the middle of the branching paths 22a and 22b on a throttle valve lower stream of a river, and arranges the air nozzle body 6 on the perimeter of the nozzle body 4 of an injection valve. The nozzle holes 9 and 91 are located in the perimeter of a tip of the fuel injection tips 4a and 4b, and the air nozzle body 6 injects the air of the throttle valve upstream from the air duct 8 which made the throttle valve of the inhalation-of-air path 22 bypass by nozzle holes 9 and 91. Nozzle holes 9 and 91 are set up so that the high-speed airstream (high-speed airstream is produced when the differential pressure of a throttle valve vertical style becomes large like [at the time of low load driving]) which makes direction 22b which is not among [SCV13] branching paths deflect the fuel injected from each injection tips 4a and 4b of a fuel injection valve 3 at the time of low load driving may blow off. If this makes nozzle holes 9 and 91 circular and it is made for the paths phi 2 of 91 to differ as the path phi 1 of a nozzle hole 9 (phi1> phi 2) It is the air blast which comes out of nozzle holes 9 and 91 colliding, and the jet of the shape of a **** ellipse shown by C of drawing 6 being formed, and changing paths phi1 and phi2 as mentioned above moreover. A

difference arises in the force of that air blast, it deviates like B of drawing 6 , the injection fuel from the injection valve nozzles 4a and 4b passing through the inside of this is also unified, and it is influenced by the above-mentioned air blast of a deviation.
[0039] Therefore, if the deviation direction B is set as the central approach of a combustion chamber 10 among the annular sections between inlet-valve 2 and a sheet as shown in C of drawing 5 , it will be guided intensively in the C region shown in drawing 5 of the inlet valve 2 of the correspondence, the fuel injected from the injection tips 4a and 4b of a fuel injection valve 3 being deflected by branching path 22b of the direction which does not have SCV13 by the high-speed airstream which blows off from air nozzles 9 and 91 at the time of low load driving. Therefore, the fuel injected from an injection valve 3 collides with the location C near the ignition plug 11 of the annular section 5 of an inlet valve 2, without being surrounded by this airstream and spread. And if an inlet valve 2 opens, the adhesion fuel of C location will be re-atomized by the air blast B like the operation stated also in the 1st example, and about 11 ignition plug of a combustion chamber 10 will be supplied.
[0040] Furthermore, at this example, at the time of low load driving, in a cylinder 11, a vortex occurs by the airstream from the branching path of one side, the whole is made to diffuse the detailed fuel with which this swirl enters in the center of a combustion chamber, and good gaseous mixture is formed because SCV13 closes.
[0041] If a load increases and it becomes heavy load operation, SCV13 will open. In this case, since the differential pressure of the vertical style of a throttle valve is in a small condition, the high-speed airstream from nozzle holes 9 and 91 does not arise, but the fuel injected separates, respectively, passes along the branching paths 22a and 22b, and collides with each inlet valves 21 and 22.
[0042] In this case, since the air rate of flow of the inhalation-of-air path 22 is quick, a fuel is atomized with the inhalation air which passes along inlet valves 2 and 21.
[0043] The structure of an injection valve 3 is shown in drawing 6 . The fuel injection tips 4a and 4b are formed in the nozzle body 4 of an injection valve 3. a valve 31 -- electromagnetism -- it can pull up according to the electromagnetic force of a coil. An injection valve 3 is attached in an inlet pipe 22 through a seal 23. The air nozzle body 6 is attached at the tip of a nozzle body 4, and the nozzle holes 91 and 92 are formed. Air is introduced into an air nozzle 6 from the throttle valve upstream through the bypass path 8 established in the inlet pipe

22.
[0044] According to this example, even if it is the engine of 2 inhalation-of-air valve specification per cylinder, the same effectiveness as the 1st example is acquired.
[0045] The fuel which is the fuel supply system of the engine of the conventional 2 inlet valves / 1-cylinder specification illustrated in order that drawing 7 might compare with the 1st example of the above and the 2nd example, and was injected from the injection valve 1 goes into a cylinder 10 through inlet valves 2 and 21. A fuel adheres to F1 of a cylinder wall, and the F2 section then. Moreover, it is the fuel supply system of the engine of 1 inlet valve / 1-cylinder specification illustrated in order that drawing 8 might compare with the 1st and 2nd example of the above, a branching path is formed in the location near the cylinder among inhalation-of-air paths, and SCV13' is prepared in one side of this branching path. In this case, when SCV13' is closed at the time of partial load operation and a fuel and inhalation air are introduced into the branching path of those without SCV13', the fuel injected from the injection valve 3 passes along an inlet valve 2, and adheres to the four Fcylinder 3 section.
[0046] In the fuel supply system of these drawing 7 and drawing 8 , although a wall surface adhesion fuel gets heat from a wall and evaporates, in order not to move to the core of a cylinder and to make gaseous mixture into homogeneity by the swirl, powerful SUKYUSSHI is required for it. Even if it produces a vertical swirl, it is difficult for fuel vapor to move to a core. In addition, although SCV13 is used also in the 2nd example, since a atomization fuel focuses in the center of a combustion chamber, it goes into it and this is spread around it from a center in this case, fault like drawing 8 is not produced.
[0047] That is, in order to solve the above problems, like the 1st and 2nd example, while on the top face of head of an inlet valve 2, an injection fuel is brought together in the location (location near an ignition plug) of combustion chamber central approach at the front like an inhalation-of-air line, and if this is re-atomized according to the Venturi effect by the high-speed airstream from an air nozzle, it can attain.
[0048] The fuel supply system of an engine another type [conventional] is shown in drawing 9 (a).
[0049] In this conventional example, although the fuel injected by the inhalation-of-air path 51 from the injection valve 50 is carried to the airstream at which it turns by the suction port of the inhalation-of-air path 52, there is airstream along the slope on the top face of head,

flow becomes a longitudinal direction, and the injection fuel which rides on this airstream collides with the combustion chamber wall surface 53, and forms liquid membrane 54. Consequently, it combusts incompletely, and liquid membrane is exhausted and becomes the cause by which the amount of unburnt hydrocarbon increases. Especially this problem is produced in a partial-load-operation region.

[0050] In order to prevent this, as shown in drawing 9 (b), form a fuel injection valve 50 in the throttle valve lower stream of a river of the inhalation-of-air path 51, and also A means 57, for example, a supplementary air path, to form high-speed airstream in about 52 engine inlet valve at the time of low load driving is arranged (about the example of the means forming of high-speed airstream). It is attained by setting up the blow-off include angle which is mentioned later and from which the supplementary air from which the outlet of this supplementary air path 57 blows off serves as flow of a lengthwise direction in the passage location of an inlet valve 52.

[0051] Since a fuel can be put on the high-speed airstream 56 from the auxiliary inhalation-of-air path 57, gaseous mixture can be formed in a combustion chamber center section and a fuel will not collide with the combustion chamber wall surface 53 even if it is at the partial-load-operation time if it does in this way, fuel adhesion is lost, combustion efficiency is made good, and the amount of the unburnt hydrocarbon under exhaust air is reduced sharply.

[0052] An example (the 3rd example) for making drawing 10 realize the principle of drawing 9 (b) is shown. This example is an example of claim 5 and claim 6.

[0053] A fuel injection valve 60 is arranged at the throttle valve 67 downstream of the inhalation-of-air path 69, this example divides the path of throttle valve 67 lower stream of a river into the main air duct 66 and the supplementary air path 63 up and down among the inhalation-of-air paths 69, and the auxiliary valve 64 is formed in the main air duct 66 used as a bottom path. An auxiliary valve 64 is controlled to close using an actuator at the time of low load driving, or it is made to be interlocked with a throttle valve 67. The outlet of the supplementary air path (top path) 63 is set up so that air may be blown off towards the location of the central approach of a combustion chamber 68 among the head peripheries of an inlet valve 61. It is made to be injected to combustion chamber central approach among the heads of an inlet valve 61 in the injection fuel by the injection valve 60.

[0054] 67 hopes that there is no bypass 67, in order to bypass a throttle valve 67, to introduce the air of the throttle valve upstream

into the nozzle of an injection valve 60, to make an injection fuel atomize and to do the following effectiveness so.
[0055] In the above-mentioned configuration, an auxiliary valve 64 is closed at the time of partial load operation. Since the air which flows on throttle valve 67 lower stream of a river is led to the supplementary air path 63 which extracted opening area by this, the air rate of flow increases and high-speed airstream is formed.
[0056] The fuel injected from the injection valve 60 collides with the combustion chamber central site on an inlet valve 61. The airstream 62 from the supplementary air path 63 is supplied so that this injected fuel may be exactly hit on an inlet valve 61. When an auxiliary valve 64 is closed, a great portion of air inhaled by the engine flows the supplementary air path 63. Thereby, the airstream 65 of a lengthwise direction is formed in a combustion chamber. Since a fuel rides on an air current and is intensively supplied to a combustion chamber central site, without gaseous mixture going to a longitudinal direction by this eddy, adhesion on a wall surface can be prevented.
[0057] Moreover, since the auxiliary valve 64 is closed, airstream does not hit a fuel 66, but the spraying direction is not bent but goes straight on in the location aimed at on the inlet valve 61.
[0058] At the time of full open operation, an auxiliary valve 64 is opened and air is inhaled without inhalation-of-air resistance by the engine.
[0059] Drawing 11 is what applied the principle of the example of drawing 10 to the engine of 2 inlet valves / cylinder mold (the 4th example), and is the example of claim 7.
[0060] It has two or more fuel injection tips to which the fuel injection valve 73 was equivalent to two inlet valves, and the branching paths 76a and 76b corresponding to inlet valves 70 and 70 are formed in the location near the cylinder among the inhalation-of-air paths 76.
[0061] The branching path is divided into Maine passage 76a' (76b') and supplementary air path (lengthwise direction air-current means forming) 76a" (76b"), respectively. Closing motion control of Maine style furnace 76a' and 76b' is carried out by the auxiliary valve 71. Although the fuel is atomized also here by the airstream supplied from the air duct 75 which bypassed the throttle valve 74, you may be the injection valve of the direction which does not have a bypass 75. It may be made for an auxiliary valve 71 to be interlocked with a throttle valve 74, and it may be driven with a negative pressure diaphragm so that it may open at the time of low loading and may operate with the negative pressure of an inlet pipe 76.

[0062] Drawing 12 is also the application (the 5th example) of drawing 10 , and is the example of claim 8.
[0063] This examples of an engine are also 2 inlet valves / cylinder mold, the branching paths 84a and 84b corresponding to each inlet valve 80 are formed in an about 85-cylinder location among the inhalation-of-air paths 84, and it is made to be injected from the fuel injection valve 81 only to one side 84b of this branching path in the fuel. It is drawing seen from width, it is divided into two near the cylinder of branching path 84b up and down, and the auxiliary valve 82 by which closing motion control is carried out according to engine loaded condition is formed in a bottom path among beam paths at this rate, and drawing 12 (b) is set up so that it may function considering the top path 83 as lengthwise direction air-current means forming.
[0064] In this example, from one inlet valve, the gaseous mixture of a fuel and air is supplied and only air is supplied from another inlet valve. If it does in this way, it is [cloth / in a combustion chamber 85 / mixed / temper] deep in a certain part, and a certain part can be made thin, it is made to burn in thin gaseous mixture, and lean burn mode can be obtained in the whole combustion chamber.
[0065] Moreover, if an auxiliary valve 82 is closed at the time of partial load operation, it passes along the path 83 of an upper half, and air will serve as flow of a lengthwise direction, will flow in the combustion chamber 85 center of an inlet valve 80, and will form a longitudinal vortex. Gaseous mixture is agitated by this eddy and mixed temper cloth serves as homogeneity.
[0066] The 6th example is shown in drawing 13 and it is the example of claim 9. This example divides a path up and down for a part of throttle valve 104 lower stream of a river of the inhalation-of-air path 107 of 1 inlet valve / cylinder, and an auxiliary valve 103 is formed in that bottom path 107b, and when this auxiliary valve 103 closes, it is made for upper path 107b to have functioned as the same lengthwise direction air-current means forming as the 5th example. 105 is a bypass for fuel atomization which leads air to the point of an injection valve 106.
[0067] According to this example, the air of the flow of a lengthwise direction flows into the combustion chamber center section of the inlet valve 89, the vortex of a lengthwise direction is generated in the center of a combustion chamber, a combustion chamber is well agitated in it, and good gaseous mixture is formed in it because air flows to path 107b in the upper half of an inlet pipe when an auxiliary valve 103 is closed.
[0068] The 7th example is shown in drawing 14 . This example is an

example of claim 10.
[0069] Although a fuel injection valve 95 is arranged also for this example at the throttle valve 91 downstream of the inhalation-of-air path 96, it is formed in the form where the supplementary air path 90 in which the auxiliary valve is not prepared bypassed the throttle valve 91. The air (supplementary air) from the throttle valve upstream introduced from the supplementary air path 90 blows off to about 94 inlet valve, and has formed the airstream of a lengthwise direction towards the location of combustion chamber central approach among between an inlet valve 94 and its sheet.
[0070] For this reason, when a throttle valve 91 is except full open (at the time of partial load operation), air flows through the supplementary air path 90, and high-speed airstream spouts from the blowdown hole 93. This airstream is injected so that it may collide with the combustion chamber central site of an inlet valve 94. For this reason, a minute eddy is formed in the center section of the combustion chamber. Gaseous mixture is agitated by this eddy and the mixed temper cloth of a combustion chamber becomes homogeneity.
[0071] Moreover, in this example, the cut valve 95 closed at the time of idle operation may be formed in the supplementary air path 90. It is because a rotational frequency will increase and fuel consumption will worsen at the time of idle operation, if the supplementary air is passed since there are few demand air contents.
[0072] In order to raise precision furthermore, as shown in the 8th example of drawing 15 , it is good to use a control valve (solenoid valve) 124 for the supplementary air path 90. 125 is the control unit of a solenoid valve 124.
[0073] An example of the timing diagram of the control action of a solenoid valve 124 is shown in drawing 16 . (b) shows the condition of the inhalation of air of a certain gas column. In this inhalation-of-air condition, a solenoid valve 124 is opened like (b), the supplementary air is supplied, and a minute vortex is formed in a combustion chamber. If the inhalation-of-air line is passing the supplementary air at the time of except, since the fuel which remained near the inlet valve will blow up to the upstream of an inlet pipe, this can be prevented if the above solenoid-valve control is performed.
[0074] Moreover, inspired air volume will increase at the time of idle operation etc., and a rotational frequency will increase it.
[0075] (Ha) shows like the inhalation-of-air line of another gas column. Corresponding to this, a solenoid valve 124 is operated like (d).
[0076] The modification (the 9th example) of the 8th example is shown in

drawing 17 . The distributor 126 was formed instead of the solenoid valve 124 of drawing 16 . A distributor 126 supplies the supplementary air to the paths 127a, 127b, 127c, and 127d corresponding to each gas column. When each gas column is like [inhalation-of-air line], the timing to supply constitutes a distributor 126 so that air may flow.
[0077] The motor which it is a rotating type, and 128 is that driving source, for example, may drive with an engine crank, and rotates synchronizing with rotation of an engine is sufficient as this distributor 126. The same actuation as the 8th example is possible also for such a configuration.
[0078] Moreover, it may replace with the solenoid valve of the 8th example of the above, and opening control of the supplementary air path may be carried out by the idle roll control unit using the solenoid valve in which continuous control is possible.
[0079] Drawing 18 is the 10th example of this invention, and is the example of claim 12.
[0080] As for this example, each engine cylinder has two inlet valves 109a and 109b, the throttle valve lower stream of a river of the inhalation-of-air path 107 branches to two corresponding to an inlet valve, and, on the other hand, the auxiliary valve 108 of this branching path by which closing motion control is carried out according to engine load operational status is formed in 107a. An auxiliary valve 108 is closed at the time of partial load operation, and is opened at the time of full open load operation.
[0081] As shown in drawing 18 (a), when a fuel is equally injected towards the both sides of the branching paths 107a and 107b when the auxiliary valve 108 is open and nothing [auxiliary valve / 108] closes, the fuel injection valve 110 is set up so that a fuel may be deflected and injected to path 107b without an auxiliary valve, as shown in drawing 18 (b).
[0082] The configuration at the tip of an injection valve of drawing 18 was shown in drawing 19 . Drawing 19 (a) is in the condition which supplies the fuel to one inlet valve, when having closed the auxiliary valve. The orbit of a fuel is deflected by applying the high-speed airstream which 113 is the blowdown path of the bypass path to which air is led for example, from the throttle valve upstream, and is spouted from this path 113 to the fuel immediately after the injection from the measuring orifice 112. This deflecting angle is path 107a of drawing 18 .
[0083] Drawing 19 (b) shows the condition of having stopped the airstream from an air duct 113. A fuel is spouted straightly, without bending. This is performed when the auxiliary valve 107 of drawing 18

opens.
[0084] according to this example, when an auxiliary valve 107 is closed, inhalation of air is supplied only from one path 107a, a big eddy is formed in a combustion chamber, and churning of air and a fuel is promoted -- making -- gaseous mixture -- formation is made good. When the auxiliary valve 107 has closed, it prevents that an injection fuel adheres to this.
[0085] The fragmentary sectional view of the 11th example and its plan, and drawing 21 are drawings which saw this example from another direction, and drawing 20 is the example of claim 13.
[0086] Engines are 2 inlet valves / cylinder mold, and this example has branched to two corresponding to inlet valves 100a and 100b in throttle valve 99 lower stream of a river of the inhalation-of-air path 96. Bypass path 96a takes in the supplementary air from the throttle valve 99 upstream of the inhalation-of-air path 96, and blows off on a throttle valve lower stream of a river. Air port 96a' of bypass path 96a is made to have countered the end side of the bridge wall 97 of a branching path in the upper location near the branching path. Moreover, the fuel injection valve 98 is arranged for the upstream very near air port 96a' on the septum 97 and the production of air port 96a'.
[0087] The airstream supplied from bypass path 96a is spouted so that it may collide with the end face of a septum 97. A minute eddy will be formed in a combustion chamber center section if it does in this way. The fuel which blew off from the injection valve 98 is distributed to a combustion chamber, being in this eddy and being spread, and the mixed temper cloth of a combustion chamber becomes homogeneity. In this case, this with it better [to have made it seldom inject a fuel in the outside 101 of inlet valves 100a and 100b] (when a fuel is supplied outside, it is because a fuel disperses in the wall of a combustion chamber and an adhesion fuel is generated.) can be attained with the directivity of spraying of an injection valve 98.
[0088] Drawing 22 (a) shows the 12th example and is the example of claim 14.
[0089] This example connects a pipe 116 to the injection tip of a fuel injection valve 115, and it was made to lead the fuel injected to the location of combustion chamber central approach among between engine inlet valves 117 and sheets through a pipe 116. If it does in this way, an injection fuel will arrive at the location gone straight on and aimed at, without the air current of an inlet pipe 118 passing.
[0090] Also in this example, it can prevent that an injection fuel adheres to a combustion chamber wall.

[0091] Drawing 22 (b) is the modification (the 13th example) of the 12th example, and is the example of claim 15. A fuel injection valve 122 is arranged on throttle valve 121 lower stream of a river, and the air of the throttle valve upstream introduced from the path 120 which bypasses a throttle valve 121 blows off from the perimeter of an injection tip of a fuel injection valve 121. The pipe 119 towards an engine inlet valve is connected to the injection tip of a fuel injection valve 122, and the include angle of a pipe 119 is set up so that the injected fuel may be led to the location of combustion chamber central approach among between engine inlet-valve 117 and sheet with the air which blows off from the bypass path 120.
[0092] Even when according to this example the same effectiveness as the 12th example is done so and also an inhalation-of-air line performs fuel injection more by the way, by the airstream which blows off through the bypass path 120 and a pipe 119 the minute eddy 65 is formed in a combustion chamber, and the fuel injected by this airstream from an injection valve 122 atomizes -- having -- gaseous mixture -- formation can be further made into fitness and, moreover, the responsibility of fuel control can be raised by the fuel supply at the time as an inhalation-of-air line.
[0093] Drawing 23 is the modification (the 14th example) of the 13th example, and, as for a different point from the 13th example, an inhalation-of-air line makes a fuel-injection stroke a front.
[0094] According to this example, the injection fuel which collided with the inlet valve 117 through the pipe 119 is atomized by the inlet valve 117 by the airstream which blows off through a pipe 119. Also in this case, a fuel carries out opening of the pipe 119 to the combustion chamber central approach on an inlet valve.
[0095] Drawing 24 is an example which shows the connection structure of the above-mentioned pipe 119 and an injection valve 122, and the air from the bypass path 120 is supplied to the chamber 123 prepared in the lower part of an injection valve 122. From here, it is supplied in a pipe 119 through a hole 124. Within a pipe 119, as an injection fuel is wrapped in air, it blows off from the edge 125 of a pipe, without colliding with a pipe wall.
[0096] Drawing 25 is other examples of the above-mentioned pipe 119, and as pipe 119 duplex path structure, it lets an injection fuel pass to the inside path 119b, and they has let the air from the bypass path 120 pass to through and outside path 119a.
[0097] Inside path 119b of a pipe 119 is made into the pressure and this level of an inlet pipe 118 through the free passage way 127. The air

which blows off from outside path 119a through opening 119a' collides with a fuel 126, and is atomized. When there is no free passage way 127, 119in pipe b becomes negative pressure with an injection fuel, and a fuel adheres to a breadth pipe wall. If the free passage way 127 is formed, the pressure within [118] inhalation of air and the pressure of 119in pipe b become equal, and breadth prevention ****** of a fuel can plan fuel antisticking.

[0098] Drawing 26 is the 15th example of this invention, and is the example of claim 17 and claim 18 in the modification of the 12th - the 14th example.

[0099] This example is what was applied to the engine of 2 inlet valves / cylinder mold, on the other hand, SCV108 of the branching path corresponding to inlet-valve 117a by which closing motion control is carried out according to engine loaded condition is formed in 118a, and the pipe 119 is introduced into direction 118b which does not have SCV among branching paths. A pipe 119 supplies a fuel only to one inlet-valve 117b, and has supplied it to the location of the combustion chamber central approach of inlet-valve 117b.

[0100] If it does in this way, a fuel will come to be distributed centering on a combustion chamber, and its ignitionability of an ignition plug 131 will improve. Moreover, if the suction port of branching path 118a is closed by SCV108, a swirl will be formed in a combustion chamber and formation of gaseous mixture and combustion will be promoted.

[0101] In the modification (the 16th example) of the 15th example, focusing on the head of inlet-valve 117b, as for drawing 27 , opening of the fuel is carried out, as for the pipe 119 so that it may be supplied. Gaseous mixture can be distributed over the core of a combustion chamber even if such.

[0102] Drawing 28 is the modification of the dual structure pipe 119, it forms the wedge mold member 135 in the edge of a pipe 119, and it sets it up so that an injection fuel may collide here. Furthermore, atomization of a fuel is attained so that the air injected by the wedge mold member 135 from outside path 119a may hit. The example (the 17th example) which used the pipe 119 of drawing 28 for drawing 29 was shown. A fuel is divided in the two directions by the wedge member 135, and is distributed to each inlet valves 117a and 117b.

[0103] Other examples of the dual structure pipe 119 are shown in drawing 30 . When blowing off from edge 119a', the air which passed along outside path 119a of a pipe 119 determines the direction of air port 119a' so that it may collide on an inlet valve 117 and in the

clearance between inlet-valve 117 and a sheet 136. If it does in this way, a fuel can flow into a direct combustion chamber, and the air spouted from a pipe 119 will form the minute turbulent flow 137 in a combustion chamber, and it is not only used for the atomization of a fuel, but will promote mixing of a fuel. Furthermore, combustion is promoted by this turbulent flow.

[0104]

[Effect of the Invention] since a atomization fuel can be supplied to a combustion chamber as mentioned above according to this invention, preventing fuel adhesion on a combustion chamber wall surface -- the gaseous mixture of a combustion chamber -- formation can be made good and combustion efficiency and exhaust air purification can be raised.

[Translation done.]

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram showing the 1st example of this invention

[Drawing 2] The explanatory view showing the fuel adhesion condition of the inlet valve after the fuel injection of the 1st example

[Drawing 3] The explanatory view showing actuation of the 1st example

[Drawing 4] The explanatory view showing actuation of the 1st example

[Drawing 5] The explanatory view showing the 2nd example of this invention

[Drawing 6] The sectional view showing the nozzle section of the injection valve used for the 2nd example

[Drawing 7] The explanatory view having shown the trouble of the conventional example

[Drawing 8] The explanatory view having shown the trouble of the conventional example

[Drawing 9] For (a), (b) is the explanatory view showing the trouble of the conventional example, and the explanatory view showing the principle of this invention.
[Drawing 10] The explanatory view showing the 3rd example of this invention
[Drawing 11] The explanatory view showing the 4th example of this invention
[Drawing 12] The explanatory view showing the 5th example of this invention
[Drawing 13] The explanatory view showing the 6th example of this invention
[Drawing 14] The explanatory view showing the 7th example of this invention
[Drawing 15] The explanatory view showing the 8th example of this invention
[Drawing 16] The timing diagram which shows the operating state of the 8th example
[Drawing 17] The explanatory view showing the 9th example of this invention
[Drawing 18] The explanatory view showing the 10th example of this invention
[Drawing 19] The explanatory view showing the nozzle section of the injection valve used for the 10th example
[Drawing 20] The explanatory view showing the 11th example of this invention
[Drawing 21] Drawing seen from another include angle of the 11th example
[Drawing 22] It is the explanatory view in which (a) shows the 12th example of this invention, and (b) shows the 13th example.
[Drawing 23] The explanatory view showing the 14th example of this invention
[Drawing 24] The explanatory view showing an example of the injection valve and pipe which are used for the 13th and 14th example
[Drawing 25] The explanatory view showing other examples of the above-mentioned pipe
[Drawing 26] the explanatory view
 showing the 15th example of this invention -- [Drawing 27] The explanatory view showing the 16th example of this invention
[Drawing 28] The explanatory view showing other examples of the above-mentioned pipe
[Drawing 29] The explanatory view showing the 17th example of this invention

[Drawing 30] The explanatory view showing other examples of the above-mentioned pipe

[Description of Notations]

1 [-- Injection nozzle body,] -- 2 An engine, 21 -- An inlet valve, 3 -- An injection valve, 4 4a -- A fuel injection tip, 5 -- Between an inlet valve and a sheet (annular section), 6 -- Air nozzle body, 8 -- A bypass path (high-speed airstream means forming), 9a, 9b -- Air port, 9 91 [-- SCV, 15 / -- A throttle valve, 22' / -- A bridge wall, 22a, 22b / -- A branching path, 57 / -- A bypass path (lengthwise direction air-current means forming), 119 / -- Pipe.] -- An air port, 10 -- A combustion chamber, 11 -- An ignition plug, 13

[Translation done.]

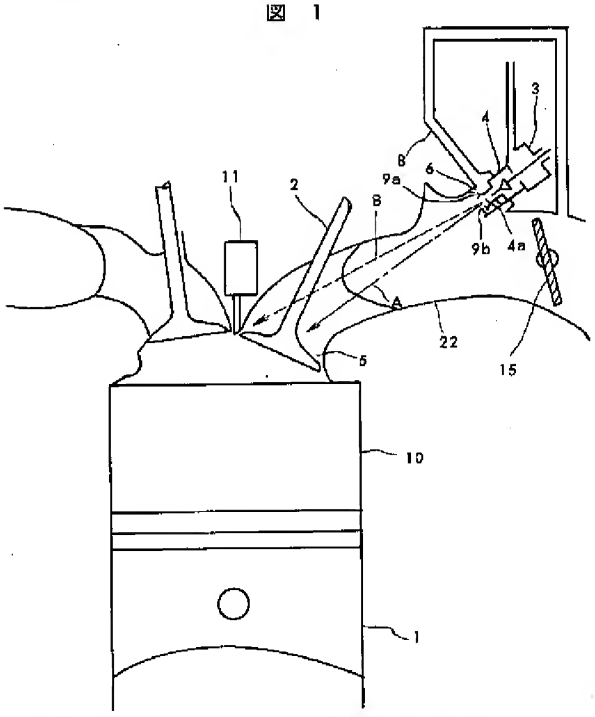
* NOTICES *

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

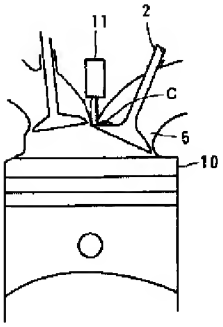
図 1



1…エンジン
2…吸気弁
3…噴射弁
4…噴射ノズルボディ
4a…燃料噴射口
5…吸気弁・シート間（環状部）
6…空気ノズルボディ
8…バイパス通路（高速空気流形成手段）
9a，9b…空気吹出口
10…燃焼室
11…点火プラグ
15…絞り弁

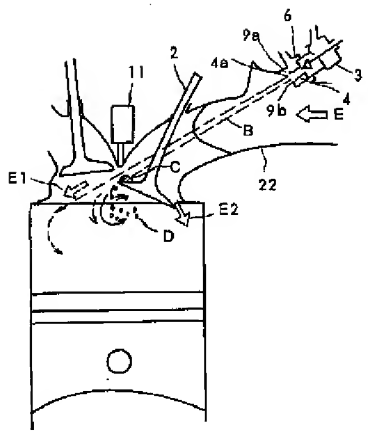
[Drawing 2]

図 2



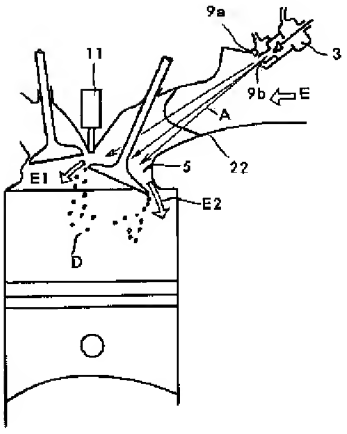
[Drawing 3]

図 3



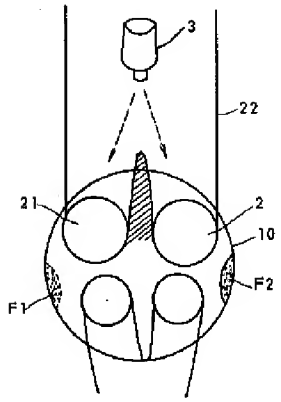
[Drawing 4]

図 4



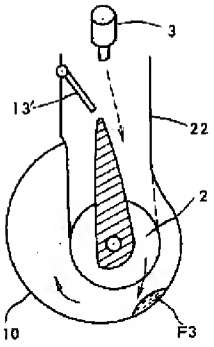
[Drawing 7]

図 7



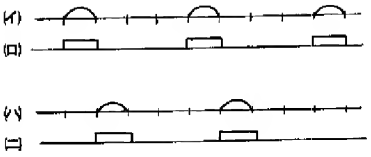
[Drawing 8]

図 8



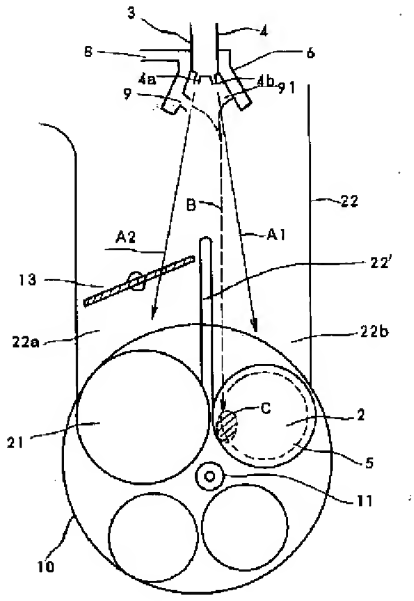
[Drawing 16]

図 16



[Drawing 5]

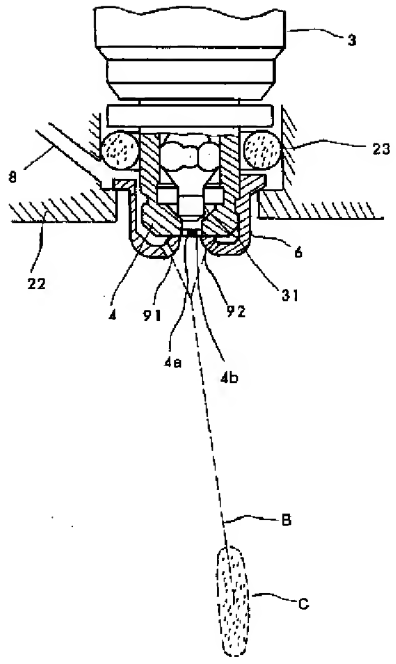
図 5



4a，4b …空気吹出口
13 …ＳＣＶ
22′ …隔壁
22a，22b …分岐通路

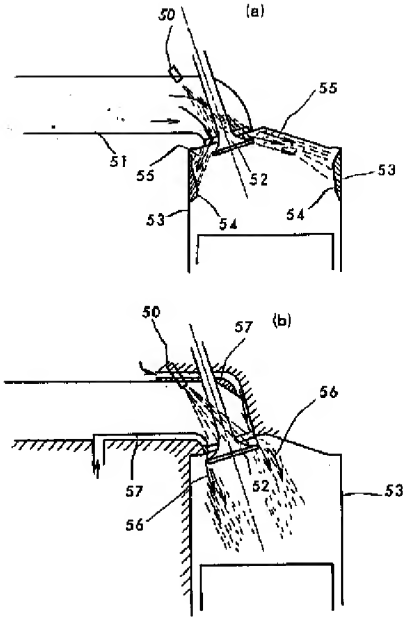
[Drawing 6]

図 6



[Drawing 9]

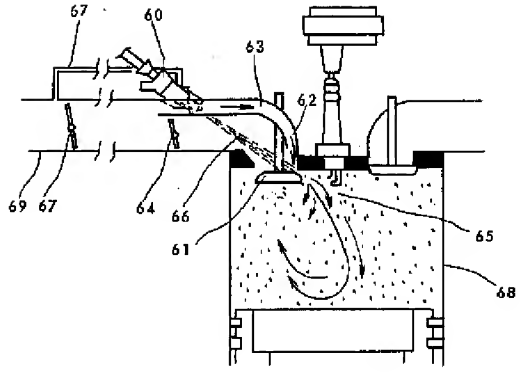
図 9



57…バイパス通路（横方向気流形成手段）

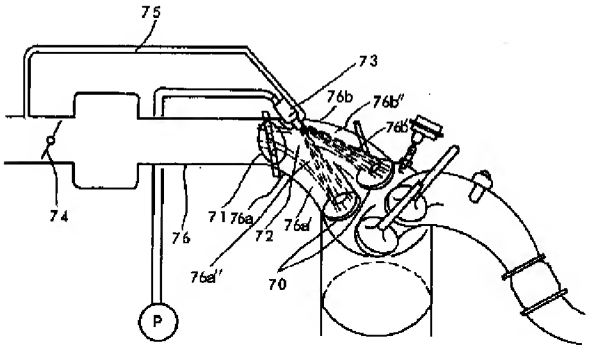
[Drawing 10]

図 10



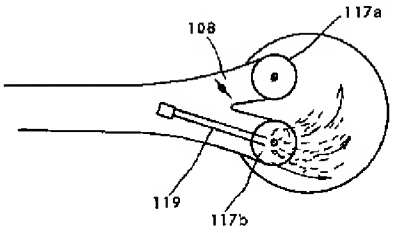
[Drawing 11]

図 11



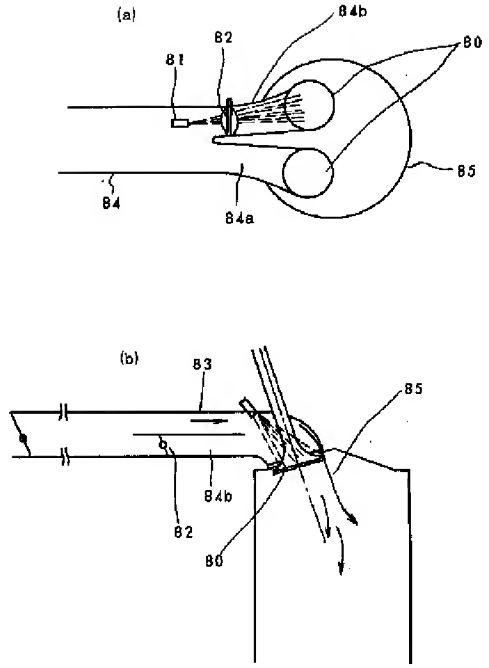
[Drawing 27]

図 27



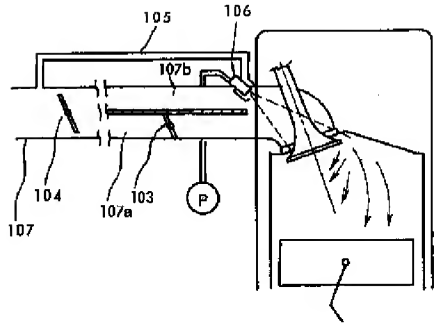
[Drawing 12]

図 12



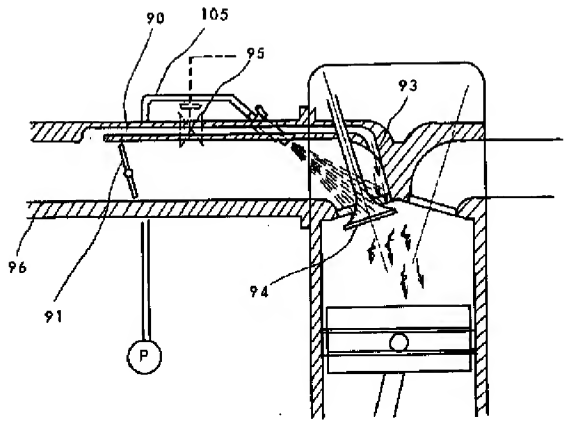
[Drawing 13]

図 13



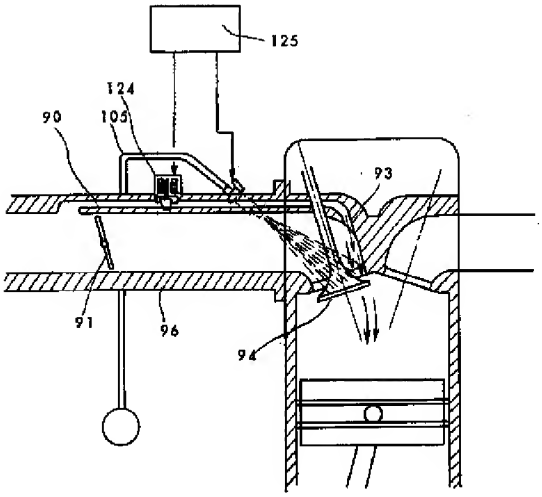
[Drawing 14]

図 14



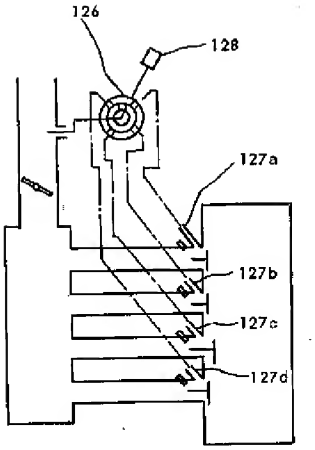
[Drawing 15]

図 15



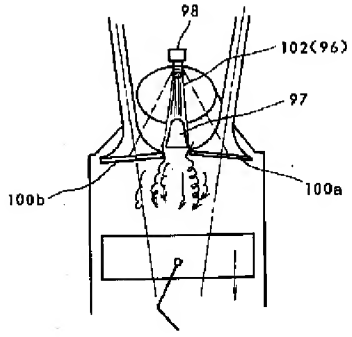
[Drawing 17]

図 17



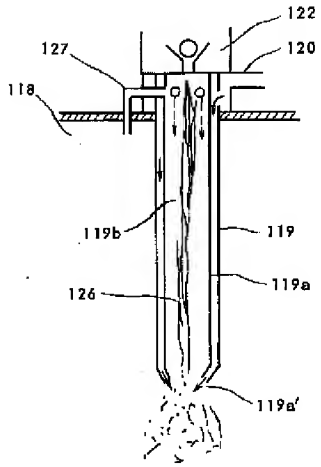
[Drawing 21]

図 21



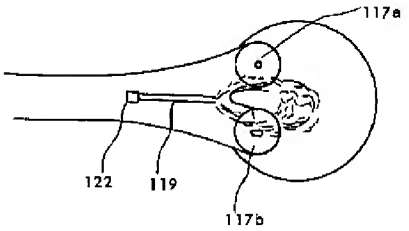
[Drawing 25]

図 25



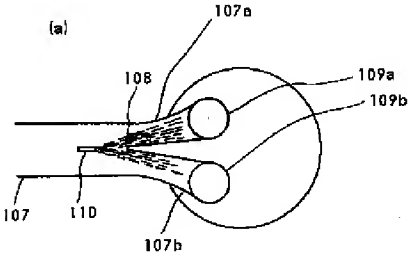
[Drawing 29]

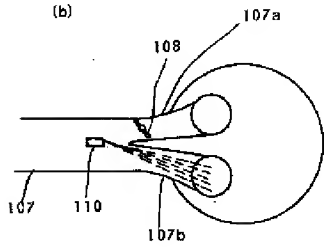
図 29



[Drawing 18]

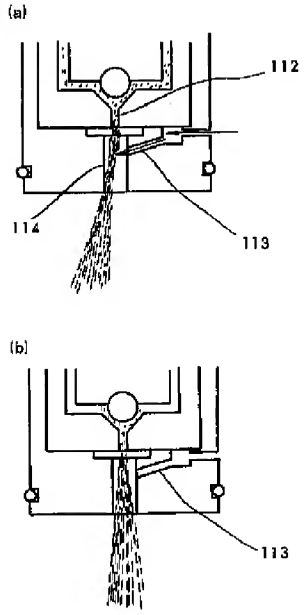
図 18





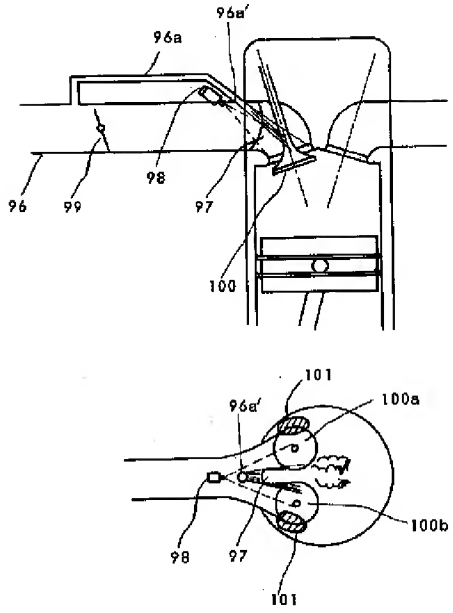
[Drawing 19]

図 19



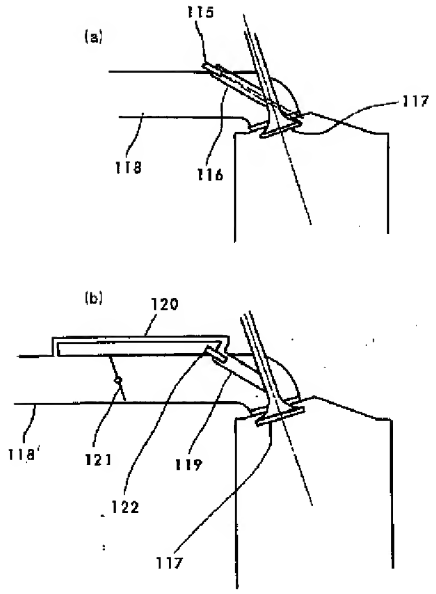
[Drawing 20]

図 20



[Drawing 22]

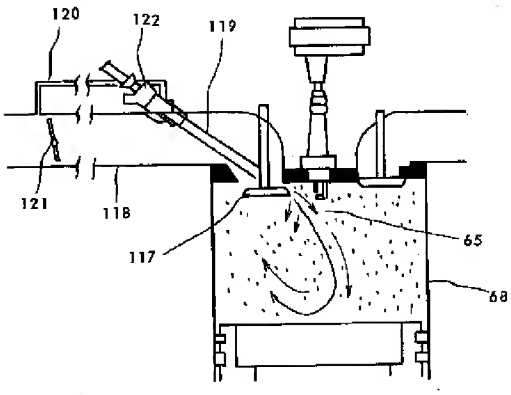
図　２２



115…燃料噴射弁
117…吸気弁
119…パイプ

[Drawing 23]

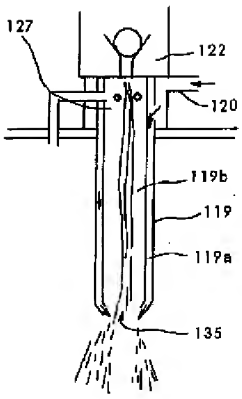
図　２３



117…吸気弁
119…パイプ
122…燃料噴射弁

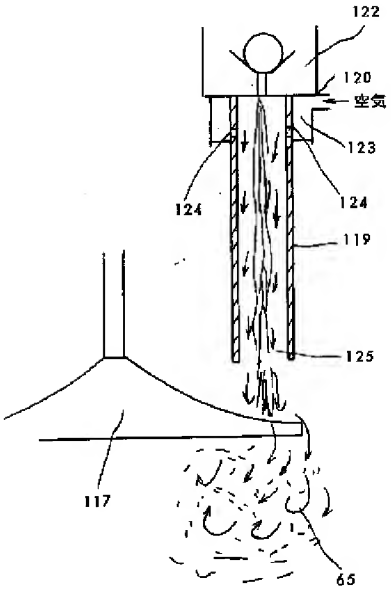
[Drawing 28]

図 ２８



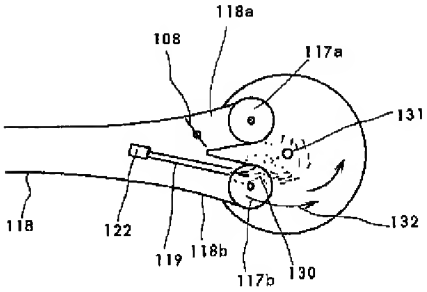
[Drawing 24]

図 ２４



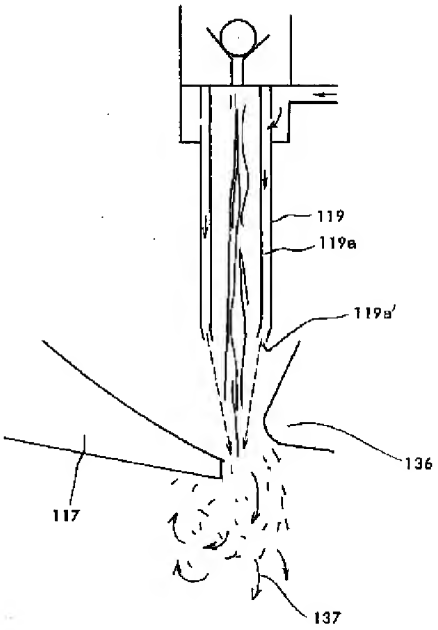
[Drawing 26]

図 ２６



[Drawing 30]

図 30



[Translation done.]

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

WRITTEN AMENDMENT

---------- [a procedure revision]

[Filing Date] June 12, Heisei 14 (2002. 6.12)

[Procedure amendment 1]

[Document to be Amended] Specification

[Item(s) to be Amended] Claim

[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] In the fuel supply system which equipped the engine inhalation-of-air path with the fuel injection valve, the path section between the throttle valve of said inhalation-of-air path and a suction port is divided up and down. An auxiliary valve is prepared in the path of the bottom of them. Said fuel injection valve The fuel supply system characterized by considering as the configuration which is prepared so that it may be attached in the upper part of said inhalation-of-air path and fuel injection may be carried out towards the inlet valve of an engine cylinder, bypasses said throttle valve around the injection tip of this fuel injection valve, and draws the air of the throttle valve upstream.
[Claim 2] It is the fuel supply system according to claim 1 with which control to be set up so that the outlet of an upper path may blow off air towards [among the head peripheries of said inlet valve] the location of the central approach of said engine cylinder among said inhalation-of-air paths divided up and down, to make it injected to combustion chamber central approach by said fuel injection valve among the heads of said inlet valve in the injection fuel, and to close said auxiliary valve at the time of low load driving, or it is made for the throttle valve to be interlocked with.
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0012
[Method of Amendment] Modification
[Proposed Amendment]
[0012] Furthermore, it sets as a desirable mode of the above (1) and (2) to the fuel supply system which equipped the engine inhalation-of-air path with the fuel injection valve. The path section between the throttle valve of said inhalation-of-air path and a suction port is divided up and down, and an auxiliary valve is prepared in the path of the bottom of them. Said fuel injection valve It is prepared so that it may be attached in the upper part of said inhalation-of-air path and fuel injection may be carried out towards the inlet valve of an engine cylinder, and what was considered as the configuration which bypasses said throttle valve and leads the air of the throttle valve upstream to the surroundings of the injection tip of this fuel injection valve is proposed. Moreover, the thing controls to be set up so that the outlet of an upper path may blow off air towards [among the head peripheries

of said inlet valve] the location of the central approach of said engine cylinder among said inhalation-of-air paths divided up and down, to make it injected to combustion chamber central approach by said fuel injection valve among the heads of said inlet valve in the injection fuel, and to close said auxiliary valve at the time of low load driving, or it was made to be interlocked with a throttle valve is proposed.
[Procedure amendment 3]
[Document to be Amended] Specification
[Item(s) to be Amended] 0021
[Method of Amendment] Deletion

[Translation done.]

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特開2003－13826
（P2003－13826A）
(43)公開日　平成15年１月15日(2003.1.15)

(51)Int.Cl.[7]	識別記号	ＦＩ		テーマコード*（参考）
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			Ｃ	３Ｇ０６５
			Ｑ	３Ｇ０６６
Ｆ０２Ｂ　31/00	３０１	Ｆ０２Ｂ　31/00	３０１Ｂ	
31/02		31/02	Ｊ	

審査請求　有　　請求項の数２　ＯＬ　（全 15 頁）　　最終頁に続く

(21)出願番号　特願2002－137163(P2002－137163)
(62)分割の表示　特願平4－176652の分割
(22)出願日　平成４年７月３日(1992.7.3)

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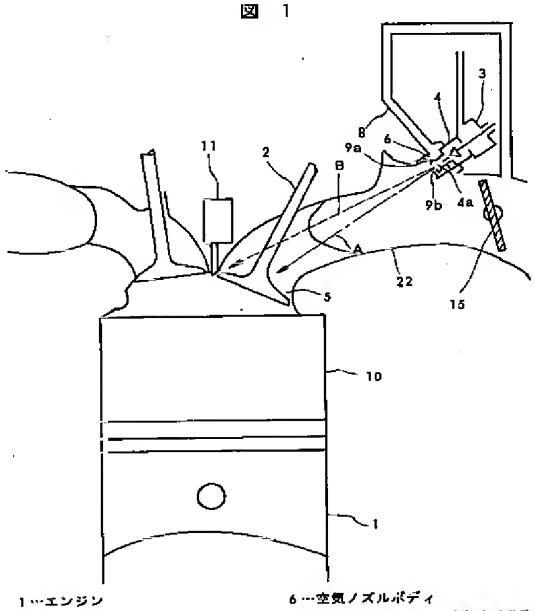
最終頁に続く

(54)【発明の名称】　エンジンの燃料供給装置

(57)【要約】
【課題】　燃焼室への燃料付着を防止しつつ、燃料微粒化向上を図って、燃焼室の混合気形成を良好にし、燃焼効率，排気浄化を高める。
【解決手段】　噴射弁３が吸気通路の絞り弁１５下流に配置される。絞り弁１５上流をバイパスする通路８から差圧を利用して絞り弁上流の空気を噴射弁３の噴射口の周囲９ａ，９ｂから吹き出す。バイパス通路８から吹き出す高速空気流が噴射燃料を囲んで燃料の拡散を防止しつつ該燃料を吸気弁２のヘッド上面のうち燃焼室中央寄りの位置或いは吸気弁・シート間５の燃焼室中央寄りに位置に導く。高速空気流形成手段は燃料及び空気流を案内させるパイプであってもよい。

図　1



【特許請求の範囲】
【請求項１】　エンジンの吸気通路に燃料噴射弁を備えた燃料供給装置において、少なくとも低負荷運転時に高速空気流を形成する手段を有し、この高速空気流及び前記燃料噴射弁の噴射燃料がエンジンの吸気弁のヘッド上面のうち燃焼室中央寄りの位置或いは吸気弁・シート間の燃焼室中央寄りの位置に集中的に到達するよう設定してあることを特徴とするエンジンの燃料供給装置。
【請求項２】　請求項１において、前記燃料噴射弁が前記吸気通路の絞り弁下流に配置され、前記高速空気流形成手段は、前記吸気通路の絞り弁をバイパスさせて絞り弁上流の空気を前記燃料噴射弁の噴射口の周囲から吹き出すバイパス通路で、そのバイパス通路から吹き出す高速空気流（高速空気流は、絞り弁上下流の圧力差により生じる）が前記燃料噴射弁の噴射燃料を囲んで燃料の拡散を防止しつつ該燃料を前記吸気弁のヘッド上面のうち燃焼室中央寄りの位置或いは吸気弁・シート間の燃焼室中央寄りの位置に導くよう設定してあることを特徴とするエンジンの燃料供給装置。
【請求項３】　請求項１において、前記エンジンは２吸気弁／シリンダ型で、前記燃料噴射弁が２吸気弁に対応した複数の燃料噴射口を有し、前記吸気通路のシリンダ近くの位置に各吸気弁に対応する分岐通路が形成され、この分岐通路の一方には、エンジンの負荷に応じて開閉制御されるスワールコントロール弁（以下、ＳＣＶと略する）が設けてあり、且つ、前記高速空気流形成手段は、前記吸気通路の絞り弁をバイパスさせて絞り弁上流の空気を前記燃料噴射弁の各噴射口の周囲から吹き出すバイパス通路で、この吹き出される高速空気流が前記燃料噴射弁の各燃料噴射口から噴射される燃料を一本化して前記分岐通路のうちＳＣＶの無い方に偏向させつつ、該燃料を高速空気流と共に片方の吸気弁のヘッド上面のうち燃焼室中央寄りの位置或いは吸気弁・シート間の燃焼室中央寄りの位置に導くよう設定して成ることを特徴とするエンジンの燃料供給装置。
【請求項４】　請求項２又は請求項３において、前記バイパス通路の空気吹出口は、前記燃料噴射弁の燃料噴射口の周囲に複数配置され、これらの空気吹出口が径を異にしていることを特徴とするエンジンの燃料供給装置。
【請求項５】　エンジンの吸気通路に燃料噴射弁を備えた燃料供給装置において、少なくとも低負荷運転時にエンジンの吸気弁・シート間の気流を縦方向の流れにする縦方向気流形成手段を備えたことを特徴とするエンジンの燃料供給装置。
【請求項６】　請求項５において、前記吸気通路の絞り弁下流の通路が２つに分岐され、この分岐通路のうち、一方の分岐通路にエンジンの負荷に応じて開閉制御される補助弁が設けてあり、該補助弁を閉じた時には、補助弁が無い方の分岐通路が前記縦方向気流形成手段として機能し、この補助弁無しの分岐通路を通過する空気が前記燃料噴射弁を迂回してエンジンの吸気弁・シート間のうち燃焼室中央寄りの位置に局部的に縦方向気流を形成するよう設定してあることを特徴とするエンジンの燃料供給装置。
【請求項７】　請求項５において、前記エンジンは２吸気弁／シリンダ型で、前記燃料噴射弁が２吸気弁に対応した複数の燃料噴射口を有し、前記吸気通路のうちシリンダ近くの位置に各吸気弁に対応する分岐通路が形成され、前記縦方向気流形成手段が、前記分岐通路ごとに設けてあることを特徴とするエンジンの燃料供給装置。
【請求項８】　請求項５において、前記エンジンは２吸気弁／シリンダ型で、前記吸気通路のうちシリンダ近くの位置に各吸気弁に対応する分岐通路が形成され、この分岐通路の一方にのみ前記燃料噴射弁から燃料が噴射されると共に、この燃料噴射される側の分岐通路のシリンダ近くが上下に二つに分けられ、この分けた通路のうち下側通路にエンジンの負荷状態に応じて開閉制御される補助弁が設けられ、上側通路を前記縦方向気流形成手段として機能するよう設定してあることを特徴とするエンジンの燃料供給装置。
【請求項９】　請求項５において、前記吸気通路の絞り弁下流の一部を上下に通路を分けて、その下側通路にエンジンの負荷に応じて開閉制御される補助弁が設けてあり、この補助弁が閉じた時に上側の通路が前記縦方向気流形成手段として機能するようにしてあることを特徴とするエンジンの燃料供給装置。
【請求項１０】　エンジンの吸気通路に燃料噴射弁を備えた燃料供給装置において、前記燃料噴射弁が前記吸気通路の絞り弁下流に配置され、且つ前記吸気通路の絞り弁上流から補助空気を導入してエンジンの吸気弁近くに吹き出す補助空気通路を設け、前記補助空気通路は、前記吸気弁とそのシート間のうち燃焼室中央寄りの位置に向けて縦方向気流の空気を吹き出すよう設定してあることを特徴とするエンジンの燃料供給装置。
【請求項１１】　請求項１０において、前記補助空気通路には、アイドル運転時に閉じるカット弁或いはアイドル回転数を制御するためのアイドル制御弁が配置されていることを特徴とするエンジンの燃料供給装置。
【請求項１２】　エンジンの吸気通路に燃料噴射弁を備えた燃料供給装置において、エンジンの各シリンダが２個の吸気弁を有し、前記吸気通路の絞り弁下流が前記吸気弁に対応して二つに分岐され、この分岐通路の一方にエンジンの負荷運転状態に応じて開閉制御される補助弁が設けてあり、前記補助弁が開いている時には、前記分岐通路の双方に向けて前記燃料噴射弁からの燃料が噴射され、前記補助弁が閉じる時には、前記燃料噴射弁の噴射燃料が前記分岐通路のうち補助弁無しの方に偏向するよう設定してあることを特徴とするエンジンの燃料供給装置。
【請求項１３】　エンジンの吸気通路に燃料噴射弁を備

えた燃料供給装置において、エンジンの各シリンダが２個の吸気弁を有し、前記吸気通路の絞り弁下流が前記吸気弁に対応して二つに分岐され、且つ、前記吸気通路の絞り弁上流から補助空気を取り入れるバイパス通路の空気吹出口を、前記分岐通路近くの上流位置で前記分岐通路の隔壁の一端面に対向させて成ることを特徴とするエンジンの燃料供給装置。

【請求項１４】　エンジンの吸気通路に燃料噴射弁を備えた燃料供給装置において、前記燃料噴射弁の噴射口には、噴射される燃料をエンジンの吸気弁のヘッド上面のうち燃焼室中央寄りの位置或いは吸気弁・シート間の燃焼室中央寄りの位置に導くパイプを接続して成ることを特徴とするエンジンの燃料供給装置。

【請求項１５】　エンジンの吸気通路に燃料噴射弁を備えた燃料供給装置において、前記燃料噴射弁が前記吸気通路の絞り弁下流に配置され、前記絞り弁をバイパスして絞り弁上流の空気を前記燃料噴射弁の噴射口周囲から吹き出すバイパス通路を有し、且つ、燃料噴射弁の噴射口にはエンジンの吸気弁に向けたパイプが接続され、このパイプの角度は、噴射された燃料を前記バイパス通路から吹き出される空気と共にエンジンの吸気弁のヘッド上面のうち燃焼室中央寄りの位置或いは吸気弁・シート間の燃焼室中央寄りの位置に導くよう設定して成ることを特徴とするエンジンの燃料供給装置。

【請求項１６】　請求項１５において、前記パイプは二重通路構造として、その内側通路に噴射燃料を通し、外側通路に前記バイパス通路からの空気を通すようにしてあることを特徴とするエンジンの燃料供給装置。

【請求項１７】　請求項１５又は請求項１６において、前記エンジンは各シリンダに吸気弁を２個備え、これに対応して前記吸気通路のうちシリンダ近くが二つに分岐され、この分岐通路の一方にエンジンの負荷状態に応じて開閉制御されるＳＣＶが設けられ、前記パイプは、前記分岐通路のうちＳＣＶの無い方に導入されていることを特徴とするエンジンの燃料供給装置。

【請求項１８】　エンジンの吸気通路に燃料噴射弁を備えた燃料供給装置において、エンジンの各シリンダが２個の吸気弁を有し、前記吸気通路の絞り弁下流が前記吸気弁に対応して二つに分岐され、且つ、前記燃料噴射弁が前記吸気通路の絞り弁下流に配置され、前記絞り弁をバイパスして絞り弁上流の空気が前記燃料噴射弁の噴射口周囲から吹き出すバイパス通路を有し、燃料噴射弁の噴射口にはエンジンの吸気弁に向けたパイプが接続され、このパイプの出口を、前記吸気通路を分岐する隔壁の上流に該隔壁の端面と近い位置で対向させて成ることを特徴とするエンジンの燃料供給装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、吸気通路に燃料噴射弁を備えたエンジンの燃料供給装置に関する。

【０００２】

【従来の技術】従来より広く実用化されている吸気ポート燃料噴射装置（燃料供給装置）では、第８回内燃機関合同シンポジウム講演論文集（’９０－１－２４，２５，東京）の１７７頁～１８１頁の“ガソリン機関の混合気形成に関する研究”に開示されている如く、燃料噴射弁の噴射燃料は、対向するシリンダ壁面の局所部分に衝突，付着し、徐々に蒸発し、シリンダ内のスワールによって輸送されるものであった。

【０００３】また、実開昭６１－８０３６５号、実開平１－７６５６０号、実開平２－１４１６７８号、実開平２－１４１６７９号公報等に開示されるように、燃料噴射弁の噴射孔の周囲に、絞り弁を迂回した補助空気通路を用いて絞り弁上流からの空気を吹き出させて燃料微粒化を図ったものや、特開昭６１－１６２６１号、特開昭６１－２２６５６３号公報に開示されるように、燃料噴射弁の噴射燃料を吸気ポート付近の吸気通路壁に衝突させると共に、吸気ポート壁に絞り弁上流からの空気を吹き出させるスワール通路を設けたり、　特開昭５９－２３１１３３号公報に開示されるように、エンジンの吸気弁近くに絞り弁上流の空気を導くパイプを設けたもの等が知られている。

【０００４】

【発明が解決しようする課題】前述したように、従来より種々の燃料供給装置が提案されているが、燃料の大部分は吸気通路壁面や吸気弁に衝突したり、吸気弁のところで曲がる空気流に運ばれてシリンダの燃焼室壁面に衝突するが、このような方式によれば、吸気通路壁面，吸気弁，シリンダ壁面に付着したその一部が蒸発しきれずに液状のまま燃焼室に入りやすい。その結果、気化されない燃料が不完全燃焼されて排気されるので、未燃炭化水素の量が多くなる原因となり、また、燃焼室内に導入される混合気が不均一となって下部に濃いガス層を形成して、燃焼効率を低下させる原因となる。

【０００５】そのため、従来は、噴射弁の燃料噴射タイミングを吸気行程前にして、吸気通壁面，吸気弁等に付着した燃料を熱により気化させているが、これだけでは、液状燃料の気化としては充分ではなく、特に低温始動時には充分ではない。

【０００６】このような問題に対処するため、従来はピストンの形状を複雑にし、スキュッシュ効果によって、混合気に乱れを与えて混合気を均一にする方法が上記論文に記載されているが、ピストンの形状が複雑になり、かつ、表面積が増し、熱損失が増大しやすい。

【０００７】その他の対策としては、噴射弁の燃料を１０ミクロンメータ以下に微細にする必要がある。しかし、気流による燃料の微粒化，超音波による微粒化等は少量のの燃料を処理できるだけで、また、壁面，吸気弁等に付着して液膜化される問題を残しているため、充分な効果を上げるまでは至っていない。

【０００８】本発明は以上の点に鑑みてなされ、その目的は、上記問題を解消して燃焼室の混同気形成を良好にし、燃焼効率，排気浄化を高めることのできる燃料供給装置を提供することにある。

【０００９】

【課題を解決するための手段】本発明は上記目的を達成するために、基本的には次のような課題解決手段を提案する。

【００１０】（１）一つは、エンジンの吸気通路に燃料噴射弁を備えた燃料供給装置において、少なくとも低負荷運転時に高速空気流を形成する手段を有し、この高速空気流及び前記燃料噴射弁の噴射燃料がエンジンの吸気弁のヘッド上面のうち燃焼室中央寄りの位置或いは吸気弁・シート間の燃焼室中央寄りの位置に集中的に到達するよう設定したものを提案する。

【００１１】（２）もう一つは、エンジンの吸気通路に燃料噴射弁を備えた燃料供給装置において、少なくとも低負荷運転時にエンジンの吸気弁・シート間の気流を縦方向の流れにする縦方向気流形成手段を備えたものを提案する。

【００１２】（３）もう一つは、燃料噴射弁の噴射口にパイプを接続して、このパイプにより、噴射燃料をエンジンの吸気弁のヘッド上面のうち燃焼室中央寄りの位置或いは吸気弁・シート間の燃焼室中央寄りの位置に導くものを提案する。

【００１３】そのほか、２吸気弁／シリンダ型エンジンについての混合特性をよくするための手段も種々提案するが、これについては、実施例で説明する。

【００１４】

【作用】（１）の課題解決手段によれば、低負荷等の部分負荷運転時であっても、高速空気流形成手段を用いて高速の空気流を局部的に発生できる。そして、例えば、吸気行程の前に噴射燃料を吸気弁に衝突させると、その衝突位置となるヘッド上面の燃焼室中央寄りに局部的な液膜が形成される。

【００１５】この状態でヘッドの付着燃料は熱で気化し、また気化されない付着燃料は、上記噴射燃料衝突と同位置或いはその近傍の吸気弁・シート間の燃焼室中央寄りの位置を狙った高速の空気流により吹き飛ばされて微粒化すると共に、高速空気流が吸気弁を通過する時のベンチュリ効果により燃料気化が促進される。

【００１６】そして、この気化燃料（微粒化燃料を含む）及び高速空気流は、燃焼室の中央寄りに入るので、シリンダ壁（燃焼室壁）への燃料の再付着を防止すると共に、焼室に発生する渦流により中央から撹拌されてその周りに拡散し燃焼室全体に良好な混合気を形成する。

【００１７】また、吸気行程時に燃料を噴射させる場合であっても、吸気弁・シート間のうち燃焼室中央寄りの位置に燃料と高速空気流を通すと、吸気弁が開いた時に吸気弁を通過する高速気流のベンチュリ効果により燃料が微粒化され、しかも吸気弁，シート間に一部燃料が付着しても、これも高速空気流の吹き飛ばしにより微粒化する。そして、微粒化燃料は、燃焼室中央にストレートに入り、この時に高速空気流により生じる渦流により撹拌されるので、上記同様の作用がなされ、良好な混合気形成を実現する。

【００１８】上記の作用は、吸気通路内の空気流速が低速状態にある低負荷運転等の部分負荷運転領域において、強制的に高速空気流を形成して良好な混合気形成を助長するので、特に有効である。高速負荷運転の場合には、吸気通路内の気流が高速状態にあるため、このような高速空気を作る手段の力を借りなくとも良好な混合気形成が可能である。

【００１９】なお、低負荷運転時の高速空気流の形成は、例えば、絞り弁の上下流に差圧を利用してバイパス通路等で絞り弁上流の空気を絞り弁下流に導き、そのバイパス通路の出口，空気吹き出し方向等を工夫することで達成される。

【００２０】（２）の課題解決手段によれば、従来の吸気弁のスロープに沿った流れ（横方向の流れ）と異なり、吸気弁・シート間の気流が縦方向になり、燃焼室内には小さな縦方向渦流を発生させて、微粒化燃料がこの微小な渦に乗って燃焼室中央から拡散していく。その結果、壁面付着は防止でき燃焼室内に均一な混合気が形成される。

【００２１】（３）の課題解決手段によれば、パイプにより燃料が拡散することなく、噴射される燃料をエンジンの吸気弁上面のうち燃焼室中央寄り或いは吸気弁・シート間のうち燃焼室中央寄りの位置に導かれるので、（１）の作用同様に、微粒化燃料を燃焼室の中央に導くことで、シリンダ壁面への燃料の付着を防止でき、良好な混合気形成を図れる。

【００２２】

【実施例】本発明の実施例を図面により説明する。

【００２３】図１～図４に本発明の第１実施例を示す。本実施例は、請求項１，２の具体例である。

【００２４】エンジン１は通常のガソリンエンジンである。吸気通路２２の絞り弁１５下流位置で吸気弁の２近くに燃料噴射弁３が配置してある。燃料噴射弁（以下、噴射弁とする）３は例えば、電磁噴射弁が使用される。噴射弁２のノズルボディ４の燃料噴射口４ａ，４ｂは吸気弁２のヘッド上面のうち燃焼室１０の中央側に向いている。

【００２５】ノズルボディ４の周りに空気ノズルボディ６が設けられて、燃料噴射口４ａ，４ｂの先端周縁に空気ノズルボディ６の噴口９ａ，９ｂが配設してある。

【００２６】噴口９ａ，９ｂは、吸気通路２２の絞り弁１５をバイパスさせた通路８の空気吹出口となるもので、バイパス通路８の入口が絞り弁１５上流に開講する。

【００２７】噴口９ａ，９ｂは例えば２個で、その形状，角度，位置は、噴射弁３から噴射される燃料が空気噴口９ａ，９ｂから吹き出される高速空気流に囲まれて吸気弁２のヘッド上面のうちシリンダ１０壁から離れた所（ここでは点火プラグ１１に近い燃焼室中央寄り）に集中的に到達するように設定してある。高速空気流は、例えば低負荷運転のような絞り弁上下流の圧力差が大きくなった場合に生じる。

【００２８】空気噴口９ａ，９ｂからの噴流は、斜めに衝突して横断面が楕円状の噴流（空気流）が合成され、且つ２個の噴口９ａ，９ｂの孔径を異ならせることで、噴流は破線Ｂ方向に偏向し、この中を通る噴射燃料も破線Ｂ方向に偏向される。この偏向Ｂ方向が環状部（吸気弁２とそのシート間）５のうち燃焼室１０中央寄りの位置、すなわち点火プラグ１１に近い方となるように、噴口９ａ，９ｂの設計をしておく。

【００２９】本実施例では、エンジン１の吸気行程の前に噴射弁３から燃料を噴出させる。

【００３０】ノズル４から噴射した燃料は、部分負荷運転時には、噴口９ａ，９ｂからの空気噴流に囲まれて拡散することなくＢ方向の軌道に乗り、図２に示すように吸気弁２のヘッド上面における点火プラグ１１に近い位置に局所的に衝突する。吸気弁２が開くと、図３に示すように噴口９ａ，９ｂからの高速空気流（この時、ノズル４からは燃料が噴射されていない）が環状部５のうち燃焼室中央寄りの位置を通過し、これにより吸気弁２に付着した燃料が吹き飛ばされて微粒化されると共に、負圧で吸引されるいわゆるベンチュリ効果により気化促進されて、燃焼室１０中央に入り、点火プラグ１１近傍に良好な混合気が形成される。

【００３１】本実施例によれば、燃料が拡散することなく吸気管壁，シリンダ壁，ピストン面に燃料が付着するのを回避できる。

【００３２】また、吸気弁２を通る空気Ｅは図３のＥ１，Ｅ２で示すごとく燃料を包むように流入し、燃料はＥ１の流れに乗って燃焼室中央に導かれ、シリンダ壁面への再付着が防止される。

【００３３】さらに、本実施例のもう一つの効果として空気ノズル６の空気により燃焼室１０内に微小な乱れをつくることができ、この小さな渦流に微粒化燃料が燃焼室中央から拡散していくので、混合気の均一形成を助長する。

【００３４】次に、エンジンの負荷が増大すると吸気管２２の圧力が増大し、噴口９ａ，９ｂの噴流Ｂの速度が低下し、図４のＡで示す如く燃料は環状部５に均一に供給されるようになる。このときは、空気ノズル６が高速空気流を形成しなくとも吸気弁２を通る空気のＥ１，Ｅ２の速度が大きくなるので吸入空気によって燃料がＤのごとく再微粒化される。

【００３５】次に第２実施例を図５，図６により説明する。第２実施例は、請求項１，請求項２，請求項３の具体例である。

【００３６】本実施例はエンジン１の各シリンダ１０が２個の吸気弁２，２１を有し、燃料噴射弁３のノズルボディ４が２吸気弁に対応した複数の噴射口４ａ，４ｂを有する方式の燃料供給装置である。

【００３７】吸気通路２２のうちシリンダ１０近くの位置に隔壁２２′を設けて各吸気弁２，２１に対応する分岐通路２２ａ，２２ｂが形成され、この分岐通路の一方２２ａには、エンジンの負荷に応じて開閉制御されるスワールコントロール弁（以下、ＳＣＶと略する）１３が設けてある。このＳＣＶ１３は、高負荷の時に開、低負荷の時に閉となる。

【００３８】一方、燃料噴射弁３は絞り弁下流で分岐通路２２ａ，２２ｂの中間に位置し、また、噴射弁のノズルボディ４の周囲に空気ノズルボディ６を配する。空気ノズルボディ６は、その噴口９，９１が燃料噴射口４ａ，４ｂの先端周囲に位置し、噴口９，９１により、吸気通路２２の絞り弁をバイパスさせた空気通路８からの絞り弁上流の空気を噴射する。噴口９，９１は、低負荷運転時に燃料噴射弁３の各噴射口４ａ，４ｂから噴射される燃料を分岐通路のうちＳＣＶ１３の無い方２２ｂに偏向させる高速空気流（高速空気流は、低負荷運転時のように絞り弁上下流の圧力差が大きくなった場合に生じる）が吹き出すよう設定してある。これは、例えば、噴口９，９１を円形とし、噴口９の径Φ１と９１の径Φ２が異なるようにすれば（Φ１＞Φ２）、噴口９，９１から出る空気噴流は衝突し、図６のＣで示した如き楕円状の噴流が形成され、しかも、上記のように径Φ１，Φ２を異ならせることで、その空気噴流の力に差が生じて図６のＢのように偏向し、この中を通る噴射弁ノズル４ａ，４ｂからの噴射燃料も一本化されて上記空気噴流の偏向の影響を受ける。

【００３９】そのため、偏向方向Ｂを図５のＣに示すように吸気弁２・シート間の環状部のうち燃焼室１０の中央寄りに設定しておけば、燃料噴射弁３の噴射口４ａ，４ｂから噴射される燃料は、低負荷運転時に空気ノズル９，９１から吹き出される高速空気流によりＳＣＶ１３の無い方の分岐通路２２ｂに偏向されつつその対応の吸気弁２の図５に示すＣ領域に集中的に案内される。従って、噴射弁３から噴射される燃料は、この空気流に囲まれ拡散することなく、吸気弁２の環状部５の点火プラグ１１に近い位置Ｃに衝突する。そして、吸気弁２が開くと、空気噴流Ｂによって第１実施例でも述べた作用と同様にしてＣ位置の付着燃料が再微粒化されて燃焼室１０の点火プラグ１１近くに供給される。

【００４０】さらに、本実施例では、低負荷運転時には、ＳＣＶ１３が閉じることで、シリンダ１１内には片側の分岐通路からの空気流により渦流が発生し、このスワールが燃焼室中央に入る微細燃料を全体に拡散させ、

良好な混合気を形成する。

【００４１】負荷が増大して高負荷運転になるとＳＣＶ１３が開く。この場合には、絞り弁の上下流の差圧が小さい状態にあるため、噴口９，９１からの高速空気流が生ぜず、噴射される燃料は、それぞれ別れて分岐通路２２ａ，２２ｂを通り、各吸気弁２１，２２に衝突する。

【００４２】この場合には、吸気通路２２の空気流速が速いために、燃料は吸気弁２，２１を通る吸入空気によって微粒化される。

【００４３】噴射弁３の構造を図６に示す。噴射弁３のノズルボディ４には、燃料噴射口４ａ，４ｂが設けられている。弁３１は電磁コイルの電磁力により引き上げられる。噴射弁３はシール２３を介して吸気管２２に取付けられる。ノズルボディ４の先端に空気ノズルボディ６が取付けられ、その噴口９１，９２が設けてある。空気ノズル６には、吸気管２２に設けられたバイパス通路８を介して絞り弁上流から空気が導入される。

【００４４】本実施例によれば、１シリンダにつき２吸気弁仕様のエンジンであっても、第１実施例同様の効果を得る。

【００４５】図７は上記第１実施例，第２実施例と比較するため例示した従来の２吸気弁／１シリンダ仕様のエンジンの燃料供給装置で、噴射弁１から噴射された燃料は、吸気弁２，２１を通りシリンダ１０に入る。そのとき、シリンダ壁のＦ１，Ｆ２部に燃料が付着する。また、図８は、上記第１，第２実施例と比較するため例示した１吸気弁／１シリンダ仕様のエンジンの燃料供給装置で、吸気通路のうちシリンダ近くの位置に分岐通路が形成され、この分岐通路の一方にＳＣＶ１３′が設けてある。この場合、部分負荷運転時にＳＣＶ１３′を閉じて、ＳＣＶ１３′無しの分岐通路に燃料及び吸入空気を導入した場合、噴射弁３から噴射された燃料は、吸気弁２を通り、シリンダ４のＦ３部に付着する。

【００４６】これらの図７，図８の燃料供給装置では、壁面付着燃料は、壁から熱をもらって蒸発するが、スワールによって、シリンダの中心に移動することはなく、混合気を均一にするためには、強力なスキュッシが必要である。縦スワールを生じさせても、中心部に燃料蒸気が移動するのは困難である。なお、第２実施例でもＳＣＶ１３を用いているが、この場合には、燃焼室中央に微粒化燃料が集中して入り、これが中央からその周りに拡散されるので、図８のような不具合は生じない。

【００４７】すなわち、以上のような問題を解消するには、第１，第２実施例のように、吸気弁２のヘッド上面のうち燃焼室中央寄りの位置（点火プラグに近い位置）に吸気行程の前に噴射燃料を集め、これを空気ノズルからの高速空気流によるベンチュリ効果により再微粒化すれば達成できる。

【００４８】図９（ａ）に、従来の別のタイプのエンジンの燃料供給装置を示す。

【００４９】この従来例において、噴射弁５０から吸気通路５１に噴射された燃料は、吸気通路５２の吸気ポートで曲がる空気流に運ばれるが、空気流はヘッド上面のスロープにそって流れが横方向になってしまい、この空気流に乗る噴射燃料が燃焼室壁面５３に衝突して液膜５４を形成する。その結果、液膜が不完全燃焼して、排気され、未燃炭化水素の量が多くなる原因となる。この問題は特に、部分負荷運転域に生じる。

【００５０】これを防止するためには、図９（ｂ）に示すように、吸気通路５１の絞り弁下流に燃料噴射弁５０を設けるほかに、エンジンの吸気弁５２近くに低負荷運転時に高速空気流を形成する手段、例えば補助空気通路５７を配設し（高速空気流の形成手段の具体例については、後述する）、この補助空気通路５７の吹出口が、吹き出される補助空気が吸気弁５２の通過位置で縦方向の流れとなる吹出角度を設定することで達成される。

【００５１】このようにすれば、部分負荷運転時であっても、補助吸気通路５７からの高速空気流５６に燃料を乗せて燃焼室中央部に混合気を形成することができ、燃料は燃焼室壁面５３に衝突することがないので、燃料付着をなくして、燃焼効率を良好にし排気中の未燃炭化水素の量は大幅に低減される。

【００５２】図１０に図９（ｂ）の原理を実現させるための一例（第３実施例）を示す。本例は、請求項５，請求項６の具体例である。

【００５３】本実施例は、燃料噴射弁６０が吸気通路６９の絞り弁６７下流側に配置され、吸気通路６９のうち絞り弁６７下流の通路を上下に主空気通路６６と補助空気通路６３とに分け、下側通路となる主空気通路６６に補助弁６４が設けてある。補助弁６４は、アクチュエータを用いて低負荷運転時に閉じるように制御するか、絞り弁６７と連動するようにする。補助空気通路（上側通路）６３の吹出口は、吸気弁６１のヘッド周縁のうち燃焼室６８の中央寄りの位置に向けて空気を吹き出すよう設定する。噴射弁６０は、噴射燃料が吸気弁６１のヘッドのうち燃焼室中央寄りに噴射されるようにしてある。

【００５４】６７は絞り弁６７をバイパスして絞り弁上流の空気を噴射弁６０のノズルに導入して噴射燃料を微粒化させるもので、以下の効果を奏するには、バイパス６７がなくともよい。

【００５５】上記の構成において、部分負荷運転時には補助弁６４が閉じられる。これにより、絞り弁６７下流に流れる空気は開口面積を絞った補助空気通路６３に導かれるので、空気流速が増大し、高速空気流が形成される。

【００５６】噴射弁６０から噴射された燃料は、吸気弁６１上の燃焼室中央側に衝突する。この噴射された燃料に、ちょうど吸気弁６１上で当たるように、補助空気通路６３からの空気流６２を供給する。補助弁６４を閉じた場合、エンジンに吸入される空気は、大部分、補助空

気通路６３を流れる。これにより、縦方向の空気流６５が燃焼室内に形成される。この渦により混合気は横方向に進むことなく、また、燃料は気流に乗って燃焼室中央側に集中的に供給されるので、壁面への付着は防止できる。

【００５７】また補助弁６４を閉じているので、燃料６６に空気流は当たらず、噴霧方向は曲げられず、吸気弁６１上の狙った位置に直進する。

【００５８】全開運転時には、補助弁６４は開かれ、吸気抵抗無しにエンジンに空気が吸入される。

【００５９】図１１は、図１０の実施例の原理を２吸気弁／シリンダ型のエンジンに応用したもの（第４実施例）で、請求項７の具体例である。

【００６０】燃料噴射弁７３が２吸気弁に対応した複数の燃料噴射口を有し、吸気通路７６のうちシリンダ近くの位置に吸気弁７０，７０に対応する分岐通路７６ａ，７６ｂが形成される。

【００６１】分岐通路は、それぞれメイン流路７６ａ′（７６ｂ′）と補助空気通路（縦方向気流形成手段）７６ａ”（７６ｂ”）とに分けてある。メイン流炉７６ａ′及び７６ｂ′は補助弁７１により開閉制御される。ここでも、燃料は絞り弁７４をバイパスした空気通路７５から供給される空気流で微粒化してあるが、バイパス７５の無い方の噴射弁であってもよい。補助弁７１は、絞り弁７４と連動するようにしてもよいし、低負荷時に開くように吸気管７６の負圧により動作するよう負圧ダイアフラムで駆動しても良い。

【００６２】図１２も図１０の応用例（第５実施例）で、請求項８の具体例である。

【００６３】本実施例も、エンジンは２吸気弁／シリンダ型で、吸気通路８４のうちシリンダ８５近くの位置に各吸気弁８０に対応する分岐通路８４ａ，８４ｂが形成され、この分岐通路の一方８４ｂにのみ燃料噴射弁８１から燃料が噴射されるようにしてある。図１２（ｂ）は横からみた図で、分岐通路８４ｂのシリンダ近くが上下に二つに分けられ、この分けた通路のうち下側通路にエンジンの負荷状態に応じて開閉制御される補助弁８２が設けられ、上側通路８３を縦方向気流形成手段として機能するよう設定してある。

【００６４】本実施例では、一方の吸気弁からは燃料と空気の混合気が供給され、もう一方の吸気弁からは空気のみが供給される。このようにすると、燃焼室８５内の混合気分布をある部分を濃く、ある部分を薄くすることができ、燃焼室全体では薄い混合気で燃焼させ、リーンバーンモードを得ることができる。

【００６５】また、部分負荷運転時に補助弁８２を閉じると、空気が上半分の通路８３を通り、吸気弁８０の燃焼室８５中央に縦方向の流れとなって流入し、縦渦を形成する。この渦により、混合気が撹拌され、混合気分布が均一となる。

【００６６】図１３に第６実施例を示し、請求項９の具体例である。本実施例は、１吸気弁／シリンダの吸気通路１０７の絞り弁１０４下流の一部を上下に通路を分けて、その下側通路１０７ｂに補助弁１０３を設け、この補助弁１０３が閉じた時に上側の通路１０７ｂが第５実施例同様の縦方向気流形成手段として機能するようにしてある。１０５は噴射弁１０６の先端部に空気を導く燃料微粒化用のバイパスである。

【００６７】本実施例によれば、補助弁１０３を閉じた時に吸気管の上半分の通路１０７ｂに空気が流れることで、吸気弁８９の燃焼室中央部に縦方向の流れの空気が流入し、燃焼室中央に縦方向の渦流を発生して燃焼室内を良く撹拌して良好な混合気を形成する。

【００６８】図１４に第７実施例を示す。本実施例は請求項１０の具体例である。

【００６９】本実施例も燃料噴射弁９５が吸気通路９６の絞り弁９１下流側に配置されるが、補助弁は設けていない、補助空気通路９０が、絞り弁９１をバイパスした形で形成されている。補助空気通路９０から導入する絞り弁上流からの空気（補助空気）は、吸気弁９４近くに吹き出し、吸気弁９４とそのシート間のうち燃料室中央寄りの位置に向けて縦方向の空気流を形成するようにしてある。

【００７０】このため、絞り弁９１が全開以外の時（部分負荷運転時）には、補助空気通路９０を通って空気が流れ、吹き出し孔９３からは、高速の空気流が噴出する。この空気流は、吸気弁９４の、燃焼室中央側に衝突するように噴射する。このため、燃焼室の中央部には、微小な渦が形成される。この渦により、混合気が撹拌されて、燃焼室内の混合気分布が均一になる。

【００７１】また、本実施例では、補助空気通路９０に、アイドル運転時に閉じるカット弁９５を設けてもよい。アイドル運転時には、要求空気量が少ないので、補助空気を流すと回転数が増加してしまい燃費が悪くなるためである。

【００７２】さらに精度を高めるには、図１５の第８実施例に示すように、補助空気通路９０に制御弁（電磁弁）１２４を用いるとよい。１２５は電磁弁１２４の制御ユニットである。

【００７３】図１６に電磁弁１２４の制御動作のタイムチャートの一例を示す。（イ）はある気筒の吸気の状態を示している。この吸気状態の時に、（ロ）のように電磁弁１２４を開けて補助空気を供給し、燃焼室内に微小な渦流を形成する。吸気行程以外の時に補助空気を流していると、吸気弁近くに残った燃料が、吸気管の上流に吹き上がるため、上記のような電磁弁制御を行えばこれを防止できる。

【００７４】またアイドル運転時などは、吸気量が多くなり、回転数が増加してしまう。

【００７５】（ハ）は、別の気筒の吸気行程を示してい

る。これに対応して、（ニ）のように電磁弁１２４を動作させる。

【００７６】図１７に、第８実施例の変形例（第９実施例）を示す。図１６の電磁弁１２４の代わりに分配器１２６を設けた。分配器１２６は、補助空気を各気筒に対応した通路１２７ａ，１２７ｂ，１２７ｃ，１２７ｄに供給する。供給するタイミングは、各気筒が吸気行程の時に空気が流れるように分配器１２６を構成する。

【００７７】この分配器１２６は、回転式で、１２８がその駆動源で、例えばエンジンのクランクで駆動しても良いし、エンジンの回転に同期して回転するモータでも良い。　このような構成でも第８実施例同様の動作が可能である。

【００７８】また、上記第８実施例の電磁弁に代えて、連続制御が可能な電磁弁を用いてアイドル回転制御ユニットにより補助空気通路を開度制御してもよい。

【００７９】図１８は本発明の第１０実施例で、請求項１２の具体例である。

【００８０】本実施例は、エンジンの各シリンダが２個の吸気弁１０９ａ，１０９ｂを有し、吸気通路１０７の絞り弁下流が吸気弁に対応して二つに分岐され、この分岐通路の一方１０７ａにエンジンの負荷運転状態に応じて開閉制御される補助弁１０８が設けてある。補助弁１０８は部分負荷運転時に閉じ、全開負荷運転時に開く。

【００８１】燃料噴射弁１１０は、図１８（ａ）に示すように、補助弁１０８が開いている時には、分岐通路１０７ａ，１０７ｂの双方に向けて均等に燃料を噴射し、補助弁無１０８が閉じる時には、図１８（ｂ）に示すように、補助弁無しの通路１０７ｂに燃料を偏向して噴射するように設定してある。

【００８２】図１９に、図１８の噴射弁先端の構成を示した。図１９（ａ）は、補助弁を閉じている時に、燃料を一方の吸気弁に供給している状態である。１１３は、例えば絞り弁上流から空気を導くバイパス通路の吹き出し通路で、この通路１１３から噴出する高速空気流を、計量オリフィス１１２からの噴射直後の燃料に当てることで燃料の軌道を偏向させている。この偏向角度は、図１８の通路１０７ａである。

【００８３】図１９（ｂ）は、空気通路１１３からの空気流を止めた状態を示している。燃料は曲がることなくまっすぐに噴出する。これは、図１８の補助弁１０７が開いた時に行われる。

【００８４】本実施例によれば、補助弁１０７を閉じた時には、吸気を一方の通路１０７ａからのみ供給し、燃焼室内に大きな渦を形成して、空気と燃料の撹拌を促進させ、混合気形成を良好にする。補助弁１０７が閉じている時には、これに噴射燃料が付着するのを防止する。

【００８５】図２０は第１１実施例の部分断面図及びその上面図、図２１は本実施例を別の方向からみた図で、請求項１３の具体例である。

【００８６】本実施例は、エンジンが２吸気弁／シリンダ型で、吸気通路９６の絞り弁９９下流が吸気弁１００ａ，１００ｂに対応して二つに分岐してある。バイパス通路９６ａは、吸気通路９６の絞り弁９９上流から補助空気を取り入れ、絞り弁下流に吹き出す。バイパス通路９６ａの空気吹出口９６ａ′を、分岐通路近くの上流位置で分岐通路の仕切壁９７の一端面に対向させてある。また、隔壁９７及び空気吹出口９６ａ′の延長線上で空気吹出口９６ａ′のすぐ近くの上流に燃料噴射弁９８が配置してある。

【００８７】バイパス通路９６ａから供給される空気流は、隔壁９７の端面に衝突するように噴出する。このようにすると、燃焼室中央部に微小な渦が形成される。噴射弁９８から噴出した燃料は、この渦にのって拡散しながら燃焼室に分散してゆき、燃焼室内の混合気分布が均一になる。この場合、燃料は、吸気弁１００ａ，１００ｂの外側１０１にはあまり噴射しないようにした方が良い（外側に燃料を供給すると、燃焼室の壁に燃料が飛散してゆき、付着燃料が発生するためである。）これは噴射弁９８の噴霧の方向性で達成することができる。

【００８８】図２２（ａ）は第１２実施例を示し、請求項１４の具体例である。

【００８９】本実施例は、燃料噴射弁１１５の噴射口にパイプ１１６を接続し、パイプ１１６を介して、噴射される燃料をエンジンの吸気弁１１７とそのシート間のうち燃焼室中央寄りの位置に導くようにした。このようにすると、噴射燃料が、吸気管１１８の気流に流されずに直進し、狙った位置に到達する。

【００９０】本実施例においても、噴射燃料が燃焼室壁に付着するのを防止できる。

【００９１】図２２（ｂ）は第１２実施例の変形例（第１３実施例）で、請求項１５の具体例である。燃料噴射弁１２２が絞り弁１２１下流に配置され、絞り弁１２１をバイパスする通路１２０から導入される絞り弁上流の空気が燃料噴射弁１２１の噴射口周囲から吹き出す。燃料噴射弁１２２の噴射口にはエンジンの吸気弁に向けたパイプ１１９が接続され、パイプ１１９の角度は、噴射された燃料をバイパス通路１２０から吹き出される空気と共にエンジンの吸気弁１１７・シート間のうち燃焼室中央寄りの位置に導くよう設定してある。

【００９２】本実施例によれば、第１２実施例同様の効果を奏するほかに、吸気行程時に燃料噴射を行った場合でも、バイパス通路１２０及びパイプ１１９を介して吹き出される空気流によって、燃焼室内に微小な渦６５が形成され、この空気流により噴射弁１２２から噴射される燃料が微粒化され、混合気形成をより一層良好にし、しかも、吸気行程時の燃料供給により燃料制御の応答性を向上させることができる。

【００９３】図２３は第１３実施例の変形例（第１４実施例）で、第１３実施例と異なる点は、燃料噴射行程を

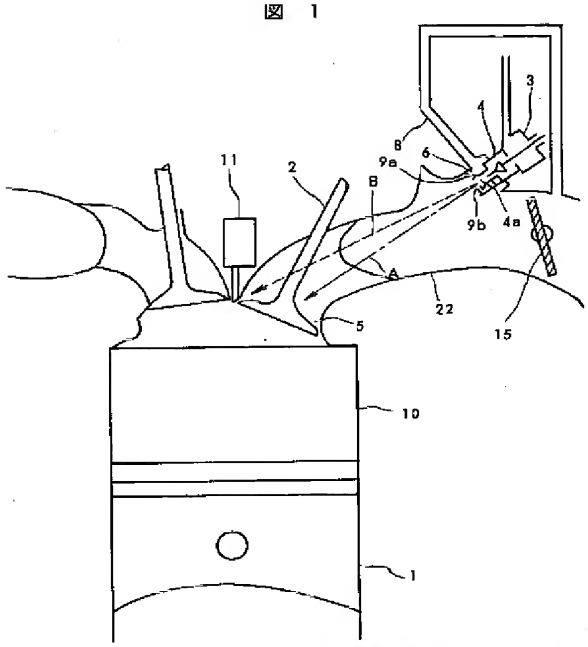
吸気行程前としたものである。
【００９４】本実施例によれば、パイプ１１９を介して吸気弁１１７に衝突した噴射燃料は、パイプ１１９を介して吹き出される空気流により吸気弁１１７で微粒化される。この場合も、燃料は吸気弁上の燃焼室中央寄りにパイプ１１９を開口する。
【００９５】図２４は上記パイプ１１９と噴射弁１２２との接続構造を示す一例で、バイパス通路１２０からの空気は噴射弁１２２の下部に設けたチャンバ１２３に供給される。ここから、孔１２４を通ってパイプ１１９内に供給される。パイプ１１９内では、噴射燃料が空気に包まれるようにして、パイプ内壁に衝突することなくパイプの端部１２５から吹き出される。
【００９６】図２５は上記パイプ１１９の他の例で、パイプ１１９二重通路構造として、その内側通路１１９ｂに噴射燃料を通し、外側通路１１９ａにバイパス通路１２０からの空気を通すようにしてある。
【００９７】パイプ１１９の内側通路１１９ｂは、連通路１２７を介して吸気管１１８の圧力と同レベルにしてある。外側通路１１９ａから開口１１９ａ´を介して吹き出される空気は燃料１２６と衝突し微粒化される。連通路１２７がない場合には、パイプ内１１９ｂは、噴射燃料により負圧になり、燃料が広がりパイプ内壁に付着する。連通路１２７を設けると、吸気管内１１８の圧力とパイプ内１１９ｂの圧力が等しくなって、燃料の広がり防止ひいては燃料付着防止を図れる。
【００９８】図２６は本発明の第１５実施例で、第１２～第１４実施例の変形例で請求項１７，請求項１８の具体例である。
【００９９】本実施例は、２吸気弁／シリンダ型のエンジンに適用したもので、吸気弁１１７ａに対応する分岐通路の一方１１８ａにエンジンの負荷状態に応じて開閉制御されるＳＣＶ１０８が設けられ、パイプ１１９は、分岐通路のうちＳＣＶの無い方１１８ｂに導入されている。パイプ１１９は、一方の吸気弁１１７ｂのみに燃料を供給し、吸気弁１１７ｂの燃焼室中央寄りの位置に供給するようにしてある。
【０１００】このようにすると、燃料は、燃焼室中心に分布するようになり、点火プラグ１３１の着火性が向上する。また、分岐通路１１８ａの吸気ポートをＳＣＶ１０８で閉じると、燃焼室内にスワールが形成され、混合気の形成，燃焼が促進される。
【０１０１】図２７は第１５実施例の変形例（第１６実施例）でパイプ１１９は吸気弁１１７ｂのヘッド中心に燃料が供給されるように開口されている。このようにしても、燃焼室の中心に混合気を分布させることができる。
【０１０２】図２８は、二重構造パイプ１１９の変形例で、パイプ１１９の端部にくさび型部材１３５を設けて、噴射燃料がここに衝突するように設定する。さらに、くさび型部材１３５に外側通路１１９ａから噴射された空気が当たるように、燃料の微粒化を図っている。図２９に図２８のパイプ１１９を用いた実施例（第１７実施例）を示した。燃料はくさび部材１３５により二方向に分割されて、各吸気弁１１７ａ，１１７ｂに分配される。
【０１０３】図３０に二重構造パイプ１１９の他の例を示す。パイプ１１９の外側通路１１９ａを通った空気は、端部１１９ａ´から吹き出される時に、吸気弁１１７上か、吸気弁１１７・シート１３６の隙間で衝突するように、空気吹出口１１９ａ´の方向を決める。このようにすると、燃料は、直接燃焼室内に流入することができ、パイプ１１９から噴出する空気は燃料の微粒化に用いられるばかりでなく、燃焼室内に微小な乱流１３７を形成して、燃料の混合を促進する。さらに、この乱流により燃焼が促進される。
【０１０４】
【発明の効果】以上のように本発明によれば、燃焼室壁面への燃料付着を防止しつつ微粒化燃料を燃焼室に供給できるので、燃焼室の混合気形成を良好にし、燃焼効率，排気浄化を高めることができる。
【図面の簡単な説明】
【図１】本発明の第１実施例を示す構成図
【図２】第１実施例の燃料噴射後の吸気弁の燃料付着状態を示す説明図
【図３】第１実施例の動作を示す説明図
【図４】第１実施例の動作を示す説明図
【図５】本発明の第２実施例を示す説明図
【図６】第２実施例に用いる噴射弁のノズル部を示す断面図
【図７】従来例の問題点を示した説明図
【図８】従来例の問題点を示した説明図
【図９】（ａ）は従来例の問題点を示す説明図、（ｂ）は本発明の原理を示す説明図
【図１０】本発明の第３実施例を示す説明図
【図１１】本発明の第４実施例を示す説明図
【図１２】本発明の第５実施例を示す説明図
【図１３】本発明の第６実施例を示す説明図
【図１４】本発明の第７実施例を示す説明図
【図１５】本発明の第８実施例を示す説明図
【図１６】第８実施例の動作状態を示すタイムチャート
【図１７】本発明の第９実施例を示す説明図
【図１８】本発明の第１０実施例を示す説明図
【図１９】第１０実施例に用いる噴射弁のノズル部を示す説明図
【図２０】本発明の第１１実施例を示す説明図
【図２１】第１１実施例の別の角度からみた図
【図２２】（ａ）は本発明の第１２実施例，（ｂ）は第１３実施例を示す説明図
【図２３】本発明の第１４実施例を示す説明図

【図２４】第１３，第１４実施例に用いる噴射弁及びパイプの一例を示す説明図
【図２５】上記パイプの他の例を示す説明図
【図２６】本発明の第１５実施例を示す説明図
【図２７】本発明の第１６実施例を示す説明図
【図２８】上記パイプの他の例を示す説明図
【図２９】本発明の第１７実施例を示す説明図
【図３０】上記パイプの他の例を示す説明図
【符号の説明】

１…エンジン、２，２１…吸気弁、３…噴射弁、４…噴射ノズルボディ、４ａ…燃料噴射口、５…吸気弁・シート間（環状部）、６…空気ノズルボディ、８…バイパス通路（高速空気流形成手段）、９ａ，９ｂ…空気吹出口、９，９１…空気吹出口、１０…燃焼室、１１…点火プラグ、１３…ＳＣＶ、１５…絞り弁、２２′…仕切壁、２２ａ，２２ｂ…分岐通路、５７…バイパス通路（縦方向気流形成手段）、１１９…パイプ。

【図１】

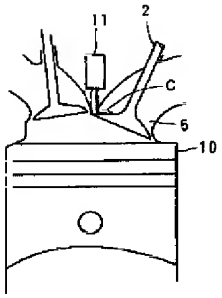
図 1



1…エンジン
2…吸気弁
3…噴射弁
4…噴射ノズルボディ
4a…燃料噴射口
5…吸気弁・シート間（環状部）
6…空気ノズルボディ
8…バイパス通路（高速空気流形成手段）
9a，9b…空気吹出口
10…燃焼室
11…点火プラグ
15…絞り弁

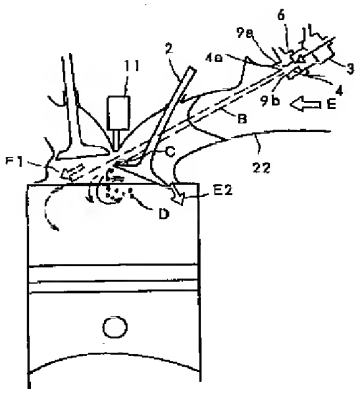
【図２】

図 2



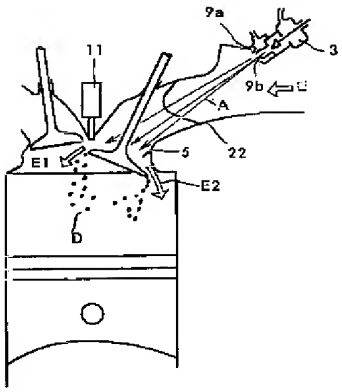
【図３】

図 3



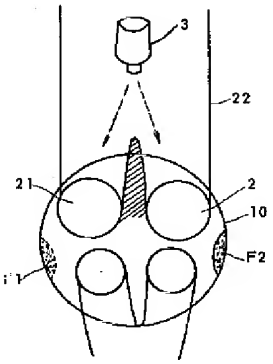
【図４】

図 4



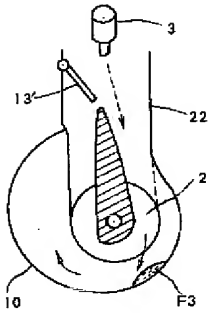
【図７】

図 7



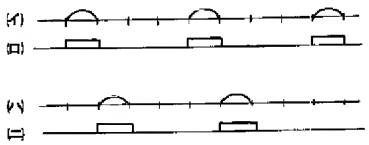
【図８】

図 8



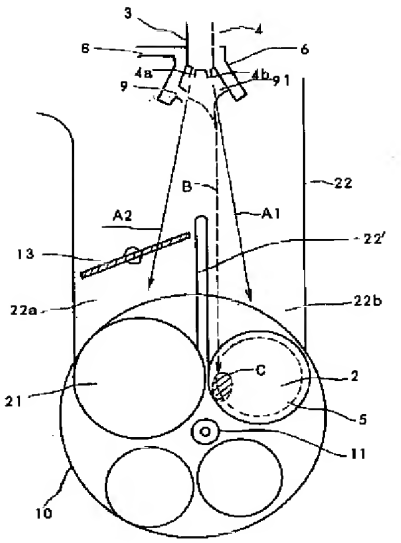
【図１６】

図 16



【図５】

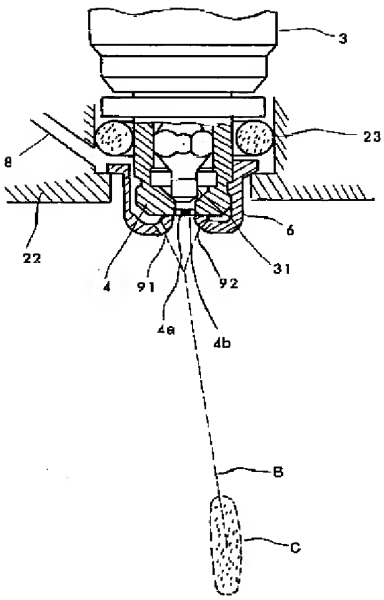
図 5



4a，4b …空気吹出口
13 …ＳＣＶ
22′ …隔壁
22a，22b …分岐通路

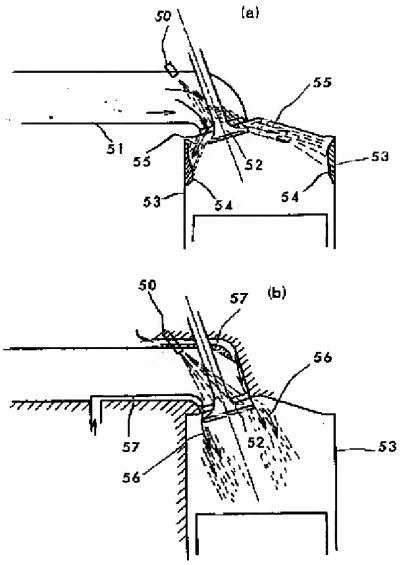
【図６】

図 6



【図９】

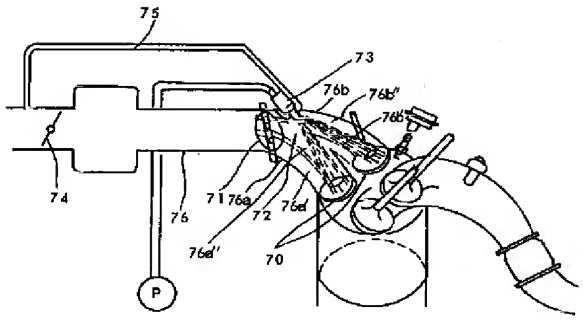
図 9



57 …バイパス通路（縦方向気流形成手段）

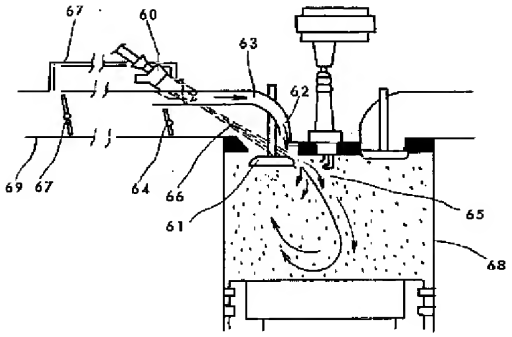
【図１１】

図 11



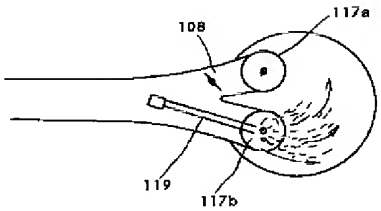
【図１０】

図 10



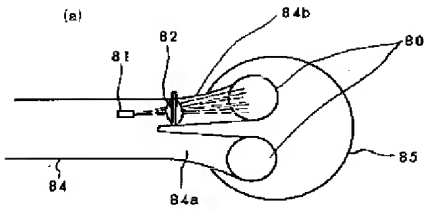
【図２７】

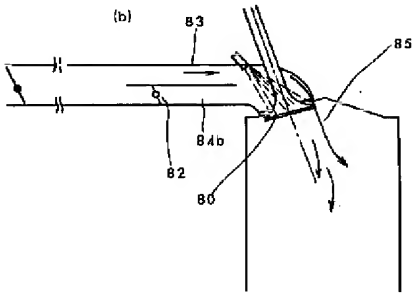
図 27



【図12】

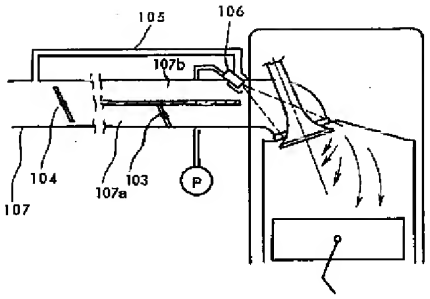
図 12





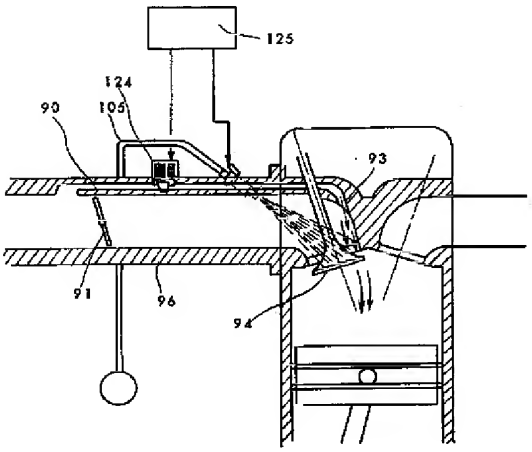
【図13】

図 13



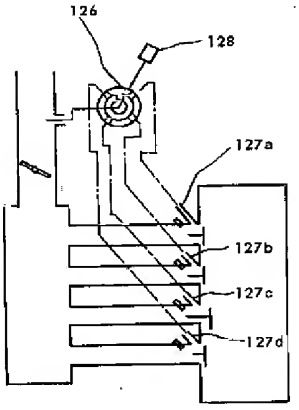
【図15】

図 15



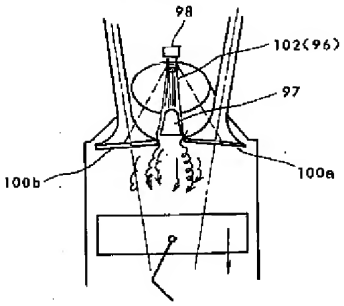
【図17】

図 17



【図21】

図 21



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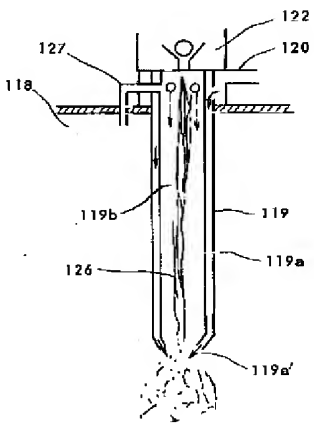

【図14】

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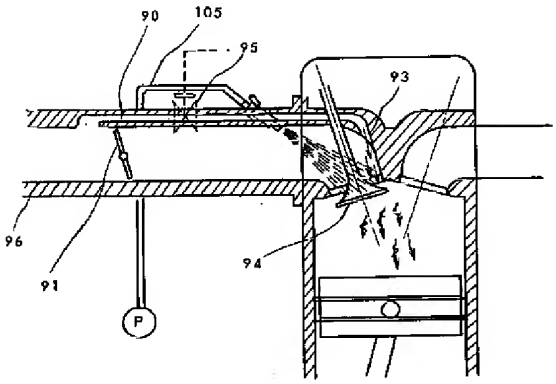
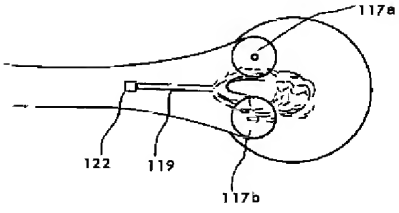


【図29】

図 29



【図18】

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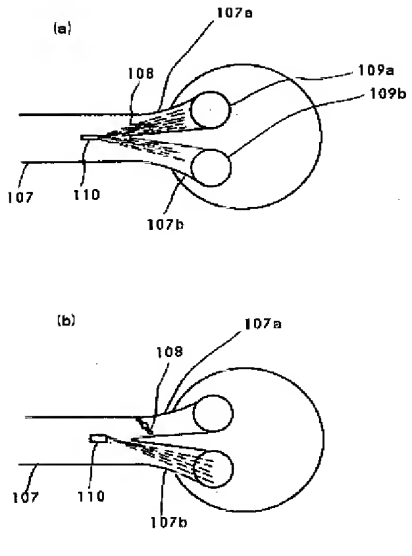

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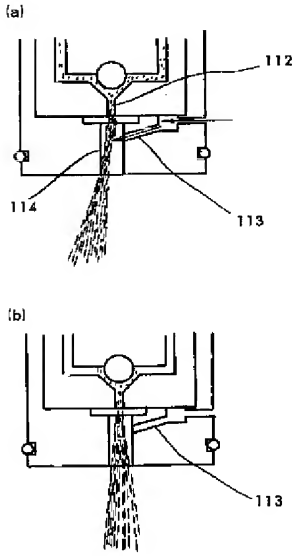
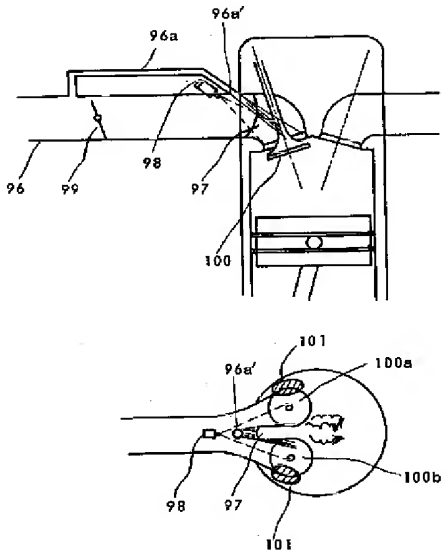
図 19



【図20】

図 20



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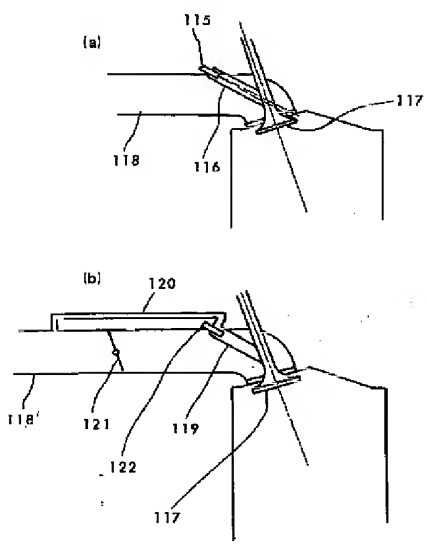
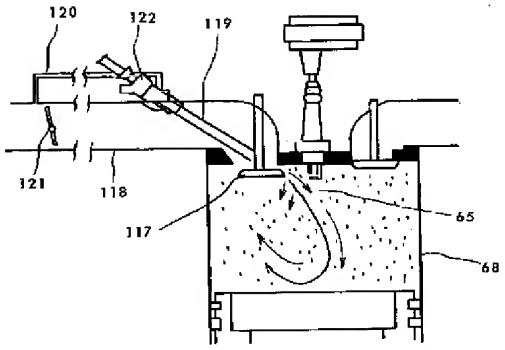


115…燃料噴射弁
117…吸気弁
119…パイプ

【図23】

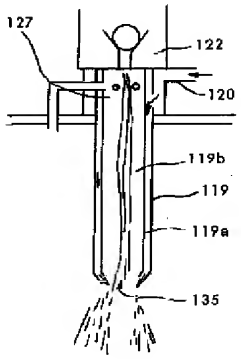
図 23



117…吸気弁
119…パイプ
122…燃料噴射弁

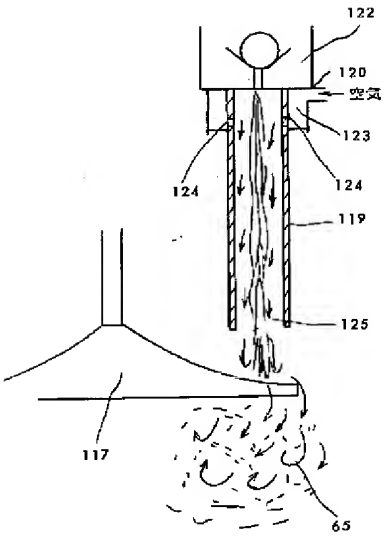
【図28】

図 28



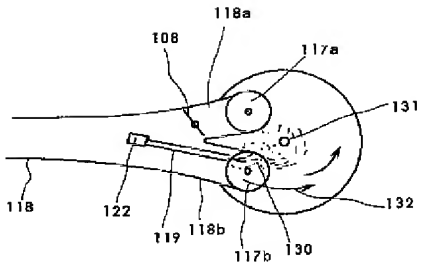
【図２４】

図 24



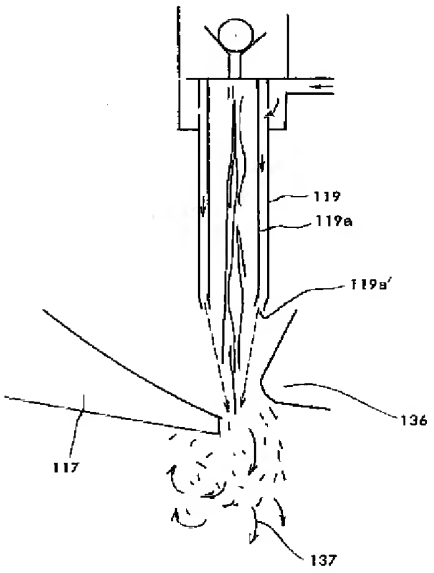
【図２６】

図 26



【図３０】

図 30



【手続補正書】
【提出日】平成１４年6月１２日（２００２．６．１２）
【手続補正１】
【補正対象書類名】明細書
【補正対象項目名】特許請求の範囲
【補正方法】変更
【補正内容】
【特許請求の範囲】
【請求項１】　エンジンの吸気通路に燃料噴射弁を備えた燃料供給装置において、前記吸気通路の絞り弁と吸気ポートとの間の通路部を上下に分けて、そのうちの下側の通路に補助弁を設け、前記燃料噴射弁は、前記吸気通路の上部に取付けられてエンジンシリンダの吸気弁に向けて燃料噴射するように設けられ、この燃料噴射弁の噴射口の周りに前記絞り弁をバイパスして絞り弁上流の空気を導く構成としたことを特徴とする燃料供給装置。
【請求項２】　前記上下に分けた吸気通路のうち上側の通路の吹出口は、前記吸気弁のヘッド周縁のうち前記エンジンシリンダの中央寄りの位置に向けて空気を吹き出すよう設定され、前記燃料噴射弁は、噴射燃料が前記吸気弁のヘッドのうち燃焼室中央寄りに噴射されるようにしてあり、前記補助弁は、低負荷運転時に閉じるように制御するか、絞り弁と連動するようにしてある請求項１記載の燃料供給装置。
【手続補正２】
【補正対象書類名】明細書
【補正対象項目名】００１２
【補正方法】変更
【補正内容】
【００１２】さらに、上記（１）（２）の好ましい態様として、エンジンの吸気通路に燃料噴射弁を備えた燃料供給装置において、前記吸気通路の絞り弁と吸気ポートとの間の通路部を上下に分けて、そのうちの下側の通路に補助弁を設け、前記燃料噴射弁は、前記吸気通路の上部に取付けられてエンジンシリンダの吸気弁に向けて燃料噴射するように設けられ、この燃料噴射弁の噴射口の周りに前記絞り弁をバイパスして絞り弁上流の空気を導く構成としたものを提案する。また、前記上下に分けた吸気通路のうち上側の通路の吹出口は、前記吸気弁のヘッド周縁のうち前記エンジンシリンダの中央寄りの位置に向けて空気を吹き出すよう設定され、前記燃料噴射弁は、噴射燃料が前記吸気弁のヘッドのうち燃焼室中央寄りに噴射されるようにしてあり、前記補助弁は、低負荷運転時に閉じるように制御するか、絞り弁と連動するようにしたものを提案する。
【手続補正３】
【補正対象書類名】明細書
【補正対象項目名】００２１
【補正方法】削除

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Ｆ０２Ｆ	1/42		Ｆ０２Ｆ	1/42	Ｆ
Ｆ０２Ｍ	51/02		Ｆ０２Ｍ	69/00	３１０Ｃ
	69/00				３６０Ｂ
		３１０			３６０Ｃ
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				69/00	３５０Ａ
					３５０Ｗ

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